Ergonomic Analysis of Seats of Human Powered Vehicles by Digital Human Modelling for Better Ride Comfort

This thesis is submitted to the Department of Mechanical Engineering of Chittagong University of Engineering and Technology in partial fulfillment of the requirements for the degree of

Master of Science (M.Sc.) in Mechanical Engineering

Submitted by

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Approval

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Declaration

It is hereby I declare that the work in this thesis is conducted and composed by myself, and the work has not been accepted for any degree and is not concurrently submitted for the award of another degree. To the best of my knowledge, contained materials were not written or published by anyone, except where due references are made.

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Abstract

Rickshaws are essential for affordable and accessible transportation, particularly in densely populated urban areas. It is important to ensure the comfort of the rickshaw driver as it directly affects their health, well-being, and job satisfaction. It also influences customer satisfaction and safety. This study focuses on modifying the rickshaw driver's seat to enhance comfort while ensuring ergonomic principles are met. As proper cushioning, support, vibration absorption, and adjustability are key factors, this study involves measurements of rickshaw frames, CAD design of seat structures, ergonomic analysis using CATIA V5, and experimental vibration analysis.

RULA and REBA analyses are performed on digital human models to evaluate posture and musculoskeletal risks associated with the conventional seat design. Modifications were suggested based on the analysis. Modified seat designs were introduced and analyzed identically to the conventional design using anthropometric data. Adjustments to handle height positively impacted driver comfort and ergonomics. These ergonomic analyses indicate that the modified design can provide more comfort to the driver. Afterward, vibration analysis is done as the springs in the driver's seat absorb shocks and vibrations, reducing fatigue and minimizing the risk of musculoskeletal issues. They contribute to overall comfort during long hours of driving. Vibration analysis is conducted to compare the conventional and modified seat designs. The modified design demonstrated better vibration absorption, indicating improved comfort for the driver.

Overall, the study provides valuable insights into the importance of rickshaw driver comfort, the role of seat design and springs, and the methods to optimize comfort and performance through ergonomic analysis and design modifications.

সারসংক্ষেপ

সাশ্রয়ী ও সহজলভ্য পরিবহনের জন্য রিকশা অপরিহার্য, বিশেষ করে ঘনবসতিপূর্ণ শহুরে অঞ্চলে। রিকশা চালকের স্বাচ্ছন্দ্য নিশ্চিত করা গুরুত্বপূর্ণ কারণ এটি সরাসরি তাদের স্বাস্থ্য, সুস্থতা এবং কাজের সন্তুষ্টিকে প্রভাবিত করে। এটি গ্রাহকের সন্তুষ্টি এবং নিরাপত্তাকেও প্রভাবিত করে। এই অধ্যয়নটি রিকশা চালকের আসন পরিবর্তন করার উপর দৃষ্টি নিবদ্ধ করে যাতে আরাম বাড়ানো যায় এবং এরগোনোমিক নীতিগুলি পূরণ করা হয় তা নিশ্চিত করা হয়। সঠিক কুশনিং, সমর্থন, কম্পন শোষণ এবং সামঞ্জস্যযোগ্যতা মূল বিষয় হিসাবে, এই গবেষণায় রিকশার ফ্রেমের পরিমাপ, সিট কাঠামোর CAD ডিজাইন, CATIA V5 ব্যবহার করে এরগোনমিক বিশ্লেষণ এবং পরীক্ষামূলক কম্পন বিশ্লেষণ জড়িত।

RULA এবং REBA বিশ্লেষণগুলি ডিজিটাল মানব মডেলগুলিতে সঞ্চালিত হয় প্রথাগত আসন নকশার সাথে সম্পর্কিত ভঙ্গি এবং পেশীবহুল ঝুঁকিগুলি মূল্যায়ন করতে। বিশ্লেষণের ভিত্তিতে পরিবর্তনের পরামর্শ দেওয়া হয়েছিল। নৃতাত্ত্বিক তথ্য ব্যবহার করে প্রচলিত নকশার সাথে অভিন্নভাবে পরিবর্তিত আসন নকশা প্রবর্তন এবং বিশ্লেষণ করা হয়েছিল। উচ্চতা সামলানোর সামঞ্জস্য ইতিবাচকভাবে ড্রাইভারের আরাম এবং এরগনোমিক্সকে প্রভাবিত করে। এই ergonomic বিশ্লেষণগুলি ইঙ্গিত দেয় যে পরিবর্তিত নকশা ড্রাইভারকে আরও আরাম দিতে পারে। পরবর্তীতে, কম্পন বিশ্লেষণ করা হয় কারণ চালকের আসনের স্প্রিংগুলি ধাক্কা এবং কম্পন শোষণ করে, ক্লান্তি হ্রাস করে এবং পেশীবহুল সমস্যার ঝুঁকি হ্রাস করে। দীর্ঘ সময় ধরে গাড়ি চালানোর সময় তারা সামগ্রিক আরামে অবদান রাখে। প্রচলিত এবং পরিবর্তিত আসন নকশা তুলনা করার জন্য কম্পন বিশ্লেষণ পরিচালিত হয়। পরিবর্তিত নকশাটি আরও ভাল কম্পন শোষণ প্রদর্শন করেছে, ড্রাইভারের জন্য উন্নত আরামের ইঙ্গিত দেয়।

সামগ্রিকভাবে, অধ্যয়নটি রিকশা চালকের আরামের গুরুত্ব, সিট ডিজাইন এবং স্প্রিংসের ভূমিকা এবং এরগনোমিক বিশ্লেষণ এবং নকশা পরিবর্তনের মাধ্যমে আরাম ও কর্মক্ষমতাকে অপ্টিমাইজ করার পদ্ধতি সম্পর্কে মূল্যবান অন্তর্দৃষ্টি প্রদান করে।

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Chapter 01

Introduction

1.1 Ergonomics

Ergonomics is the scientific discipline that investigates the relationship between individuals and their surroundings, emphasizing the design and arrangement of systems, products, and environments to enhance human well-being, performance, and safety [1-2]. The term ergonomics comes from two Greek words- ERGO and ENORMOUS, which mean "work" and "natural laws" respectively. Thus, ergonomics means natural laws of working [3]. The field seeks to understand and incorporate the capabilities and limitations of individuals to create more comfortable, efficient, and user-friendly designs [4]. Comfort is a state of well-being resulting from a lack of disturbances. It includes aspects like vibration, acoustic conditions, thermal sensation, tactile experiences, vision, and smell [5]. In vehicle systems, comfort is highly dependent on the seat designs as well as seat set-ups. Seat design is crucial for postural comfort, reachability, and visibility, collectively contributing to the overall comfort experience in a vehicle [6].

Ergonomics reduces different kinds of risk factors while working along with ensuring a comfortable environment [7-8]. There are occupational risk factors contributing to Work-Related Musculoskeletal Disorders (WMSDs). Significant risk criteria are to be acknowledged, involving transporting, continuous movement, repeating action, or supporting loads with potential injury risks [9]. Primary occupational risk factors include the force of movements (mechanical effort), awkward postures, repetition, vibration (from tools), temperature (cold affecting flexibility), contact stress (injury from sharp objects), and extrinsic stress (organizational factors) [10]. The importance of addressing these factors to prevent WMSDs and promote musculoskeletal health in the workplace is especially important [11-12]. Several ergonomic challenges impact the health and productivity of workers [13]. These challenges arise from the nature of tasks, machinery operation, and workplace design [14]. Addressing these issues is crucial for maintaining a safe and healthy work environment. Workers often engage in repetitive tasks on production lines, leading to muscle fatigue and the risk of musculoskeletal disorders. Designing jobs to reduce repetitive motions and incorporating job rotation can help mitigate these issues. Moreover, the need to adopt awkward or uncomfortable positions during certain working processes can contribute to discomfort and musculoskeletal strains. Improving workstation design and tool placement can minimize the need for awkward postures. Implementing proper lifting techniques, providing mechanical assistance, and optimizing the layout of work areas can reduce the risk of load-handling injuries. Workers operating vibrating machinery may experience hand-arm vibration syndrome [15]. Implementing vibration-damping measures, providing anti-vibration tools, and scheduling breaks to reduce exposure can help manage this trouble [16]. Poorly designed workstations, including uncomfortable seating arrangements and inadequate space, contribute to discomfort and decreased productivity. Redesigning workstations to accommodate ergonomic principles can improve overall worker well-being. Lack of education on proper ergonomics and safe work practices may result in workers adopting harmful habits. The aging workforce may be more susceptible to musculoskeletal issues. Adapting workstations, providing ergonomic accommodations, and offering flexibility in job responsibilities can support the health and productivity of older workers. Addressing these ergonomic challenges requires a holistic approach involving ongoing risk assessments, worker involvement in the design process, and the continuous improvement of workplace conditions [17]. Prioritizing ergonomic principles not only safeguards the health of manufacturing workers but also contributes to sustained productivity and a positive work environment. Initially, vehicles were focused on mechanical functionality rather than human ergonomics. Over time, occupant packaging, particularly for the driver's workstation, gained significance. The aim is to ensure driver comfort and efficient interaction with controls, expressed as a percentage of the population achieving a target level of fit or comfort [18]. The Society of Automotive Engineers (SAE) introduced standardized tools, such as the H-point machine and the eyellipse model, in the late 1950s and 1960s, respectively. These tools aid in defining seating positions and eye locations for drivers. Statistical models like seating accommodation and driver's head clearance contour provide design guides based on specific population percentages. Afterward, Digital human models (DHM), like Ramis and Jack, have become common in vehicle interior design, replacing traditional SAE tools.

Nowadays, manikins are used in ergonomic analyses, representing population percentiles rather than individual behaviors. Designers often choose extreme body dimensions to streamline computer analyses. Five elements must be considered in motor vehicle ergonomics: habitability, accessibility, reachability, internal and external visibility, and seating comfort [19].

1.2 Ergonomics in Human-Automated Vehicle

Ergonomics in human-automated vehicles refers to the design and interaction considerations between humans and autonomous or semi-autonomous vehicles [20]. The goal is to create a system that optimally integrates automation while ensuring comfort, safety, efficiency, and a positive user experience [21]. One of the key aspects of ergonomics in human-automated vehicles is user Interface Design. The design of interfaces, both physical and digital, plays a crucial role. Clear and intuitive controls, displays, and feedback mechanisms are essential for effective communication between the vehicle and the human occupant. Ergonomics focuses on how humans interact with automated systems. This involves understanding user expectations, cognitive load, and the ability to intervene or override automated functions when necessary [22]. Seating and Interior Layout also must be acknowledged. The ergonomic design of vehicle interiors considers factors such as seating comfort, visibility, and reachability of controls. Since the role of the driver may shift from active control to passive monitoring, the seating arrangement and interior layout need to adapt accordingly [23]. Ergonomics also addresses how alerts and notifications are presented to users. The timing, modality (visual, auditory, haptic), and clarity of alerts play a critical role in conveying information without causing confusion or distraction. Ergonomic considerations extend to how users are trained to interact with automated features. Ensuring that users are familiar with the capabilities and limitations of the automated system contributes to safer and more efficient use. It also familiarizes the users with responding to emergencies [24]. Ergonomics aims to balance the physical and mental workload between the automated system and the human occupant. This involves optimizing task allocation and ensuring that the automation complements human abilities rather than adding unnecessary stress [25, 26]. Human-automated vehicles should be designed to accommodate individual user preferences. Customizable settings for comfort, automation levels, and interaction preferences contribute to a more personalized and user-friendly experience [27].

By incorporating these ergonomic principles into the design and operation of human-automated vehicles, manufacturers can enhance user satisfaction, safety, and overall usability of these advanced transportation systems [1, 5, 28-30].

1.3 Rapid Upper Limb Assessment (Rula) Analysis

The Rapid Upper Limb Assessment (RULA) is an ergonomic assessment method used to evaluate the risk factors associated with musculoskeletal disorders (MSDs) in the upper body as shown in figure 1.1 and figure 1.2. It focuses on analyzing the posture of workers during manual tasks, particularly emphasizing the neck, trunk, and upper limbs[31]. RULA is a subjective observational method that aims to identify and address ergonomic issues that may contribute to discomfort and pain in industrial settings [31-32].

RULA is designed to assess and analyze the postures of workers engaged in manual tasks, to identify potential risk factors contributing to musculoskeletal disorders. The assessment primarily concentrates on the upper part of the body, including the neck, trunk, and upper limbs. This focus is crucial as these body parts are often prone to stress and strain during various work activities. RULA is a subjective method that relies on the visual observation of a trained assessor.

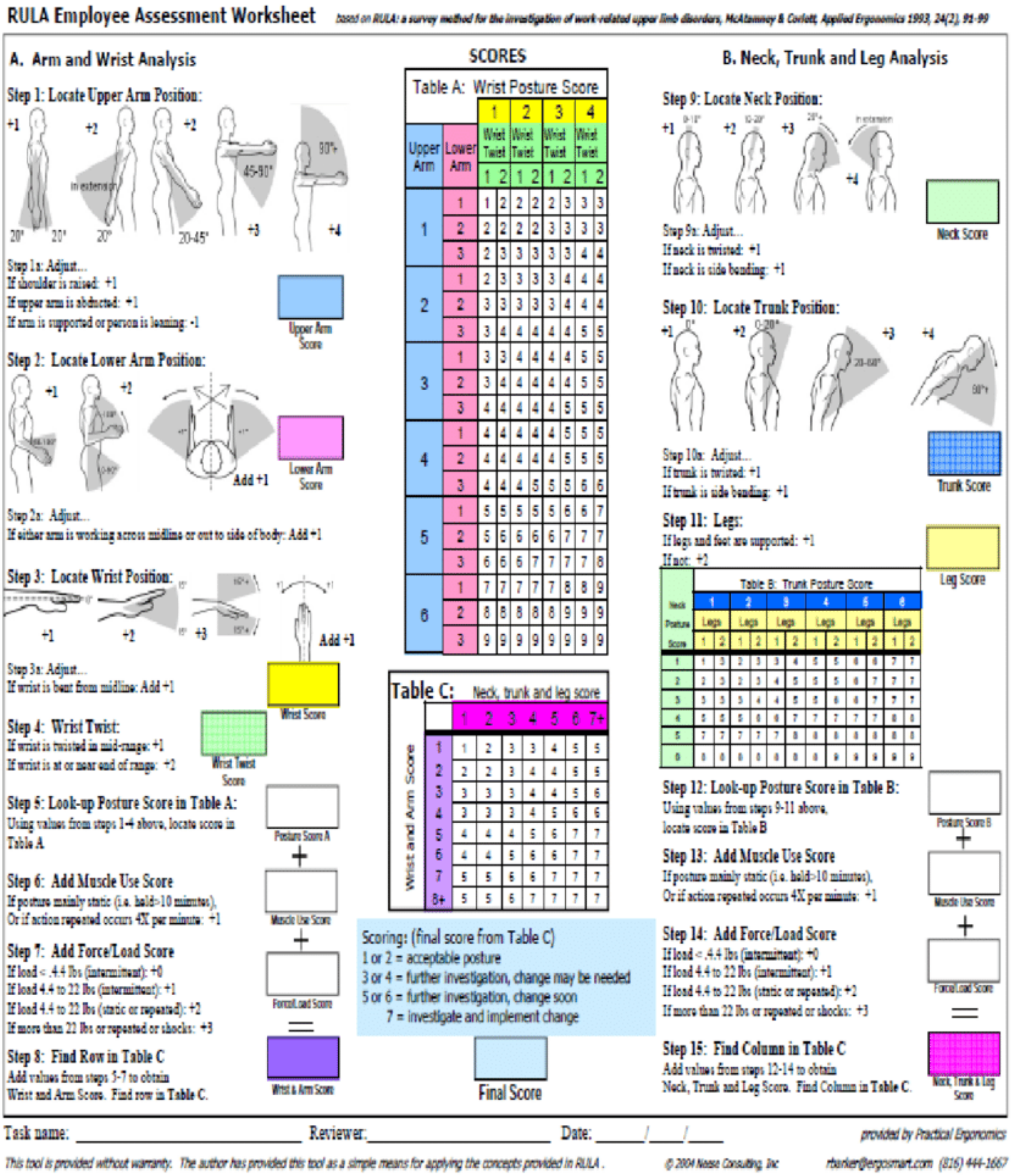


Fig. 1. 1: Rapid Upper Limb Assessment (RULA) Analysis (Adapted from [32])

Score	Level of MSD Risk
1 - 2	neglibible risk, no action required
3 - 4	low risk, change may be needed
5 - 6	medium risk, further investigation, change soon
6+	very high risk, implement change now

Fig. 1. 2: RULA score chart and MSD risk levels (Adapted from [16])

The assessor evaluates the worker's posture based on predetermined criteria to determine the risk levels associated with different body positions. It categorizes postures into different risk levels, ranging from acceptable to high risk. High-risk postures are those that may contribute to discomfort and musculoskeletal issues, requiring intervention for improvement. The primary purpose of RULA analysis is to identify postures that may lead to musculoskeletal disorders and implement preventive measures or interventions. This can include changes in workstations, tools, or work processes to improve ergonomics and reduce the risk of injury [16]. It provides a practical and efficient way to assess and address ergonomic issues in various industries where manual tasks are prevalent. Integration with Software: RULA analysis can be conducted through CATIA software, indicating the integration of digital tools for ergonomic analysis [32-33].

In summary, RULA analysis is a valuable tool for evaluating and mitigating the risk of musculoskeletal disorders among workers engaged in manual tasks. Its focus on upper body postures and its subjective observational approach makes it a widely used method in the field of ergonomics.

1.4 Rapid Entire Body Assessment (Reba) Analysis

The Rapid Entire Body Assessment (REBA) is an ergonomic analysis tool used to evaluate and assess the risk factors associated with musculoskeletal disorders (MSDs) throughout the entire body (shown in figure 1.3). Similar to RULA (Rapid Upper Limb Assessment), REBA is designed to identify and address ergonomic issues during various work activities [12, 32, 34-35]. REBA assesses the entire body, taking into consideration the posture and movements of workers during a specific task. This includes the lower back, legs, and entire upper body, providing a more holistic view of ergonomic risk factors. The analysis involves observing and evaluating the postures of workers engaged in manual tasks.

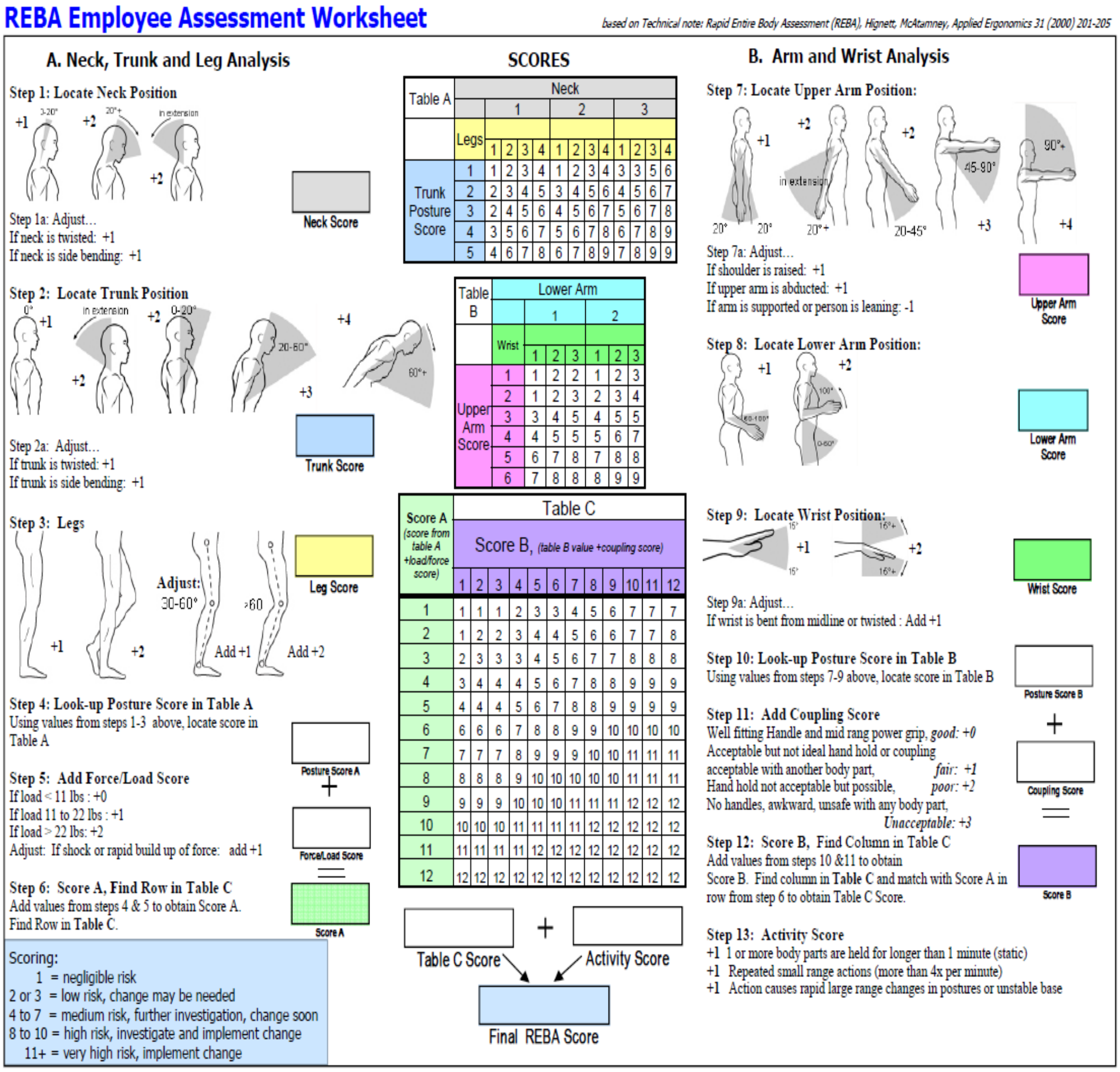


Table A	Neck	1				2				3			
	Legs	1	2	3	4	1	2	3	4	1	2	3	4
Trunk Posture Score	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

Table B	Lower Arm	1			2		
	Wrist	1	2	3	1	2	3
Upper Arm Score	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

Score A (score from table A +load/force score)	Table C — Score B, (table B value +coupling score) 1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	10	11	11	11
9	9	9	9	10	10	10	11	11	11	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

Fig. 1. 3: REBA analysis (Adapted from [32])

The assessor considers factors such as body position, joint angles, and the duration of specific postures to determine the level of risk associated with each aspect. Similar to RULA, REBA categorizes postures into different risk levels, ranging from low to high.

High-risk postures are those that may contribute to discomfort, fatigue, or musculoskeletal issues, signaling the need for intervention. REBA provides action levels or guidelines for each risk category. These guidelines help in determining the urgency and extent of corrective actions needed to improve the ergonomic conditions for workers. REBA is flexible and can be applied to various work environments and tasks. It is particularly useful in jobs that involve dynamic movements and a combination of upper and lower body actions. The assessment relies on the visual observation of an assessor who considers factors such as posture, force exertion, duration of tasks, and repetition. It is a subjective method and requires trained assessors for accurate results. The primary goal of REBA analysis is to identify problematic postures and work conditions, leading to the implementation of interventions and improvements. This can involve changes in workstations, equipment, or work processes to enhance ergonomics and reduce the risk of injuries [35].

In summary, REBA is a comprehensive ergonomic assessment tool that evaluates the risk factors associated with musculoskeletal disorders throughout the entire body. Its flexible application and focus on actionable recommendations make it a valuable tool in improving workplace ergonomics and promoting the health and well-being of workers. Ergonomics involves a multidisciplinary approach that requires knowledge from several branches of engineering and sciences [36].

1.5 Digital Human Modeling for Vehicle Ergonomics

Along with the technical unceasing development, people further knew the human, machine, and environment in product design, and the ergonomics application gradually moved towards the practical stage, especially the vehicle design aspect. Along with the computer technology especially the computer-aided design technology (CAD/CAE/CAM) development, virtual reality technical and high-performance graph technology breakthrough, the ergonomics gradually from the theoretical formula computation, the experience material accumulation as well as the simple application computation moved towards the computer assistance ergonomics design technology. Therefore, it is important for us to develop an assistance ergonomics design system, that suits our country human body characteristics [37]. Several computer-aided design and assessment programs have been developed over the years for the design of human workspace [38].

The use of DHM applications and integration have noticeable advantages in product development and digital manufacturing. The number of design changes and the cost of rapid prototyping can be minimized by DHM integration. DHM uses digital humans as representations of the workers inserted into a simulation or virtual environment to facilitate the prediction of performance and/or safety. Also, it includes visualizations of humans with math and science in the background. Applications that incorporate DHM have the potential to enable engineers to integrate ergonomics and human factors engineering principles earlier in the design process [39]. One of the advantages of the DHM applications is that Motion Capture tools can be used to drive the DHM and facilitate reduction of injuries & comfort prediction through virtual interactive design of workstations and new products. This method allows manufacturers and designers to predict potential risks before production begins [40-42]. The essential components of the vehicle are the driver seat as well as passenger seat. The expectation of the customer is increasing continuously to get a comfortable position for driving and sitting. The design of seats in a vehicle has always been a challenging feat for engineers due to its complexity. The design engineer must consider the fact that it must satisfy specific design objectives. The primary goals to be considered for design are safety, comfort, and small space [29]. Since the vehicle sector is a developing sector, there must be a worldwide need to make do with the contenders and fulfill the requirements of the client. Subsequently, it cleared a route to the appearance of different items in the market over some time. Furthermore, the produced models may have new variations concerning the past ones [26, 43]. In these variations, numerous changes may come yet the driver lodge is especially basic in these redesigns. These changes may likewise happen because of wounds, to give well-being to the driver during any effect at the front and to the passenger at the back [6]. Today is an industrialized world and we may see that the most widely recognized movement done by the individual is the sitting posture [44]. It may have different sick impacts on the body parts like the neck, back, and so forth, and when it is untreated it turns into a significant issue. Thinking about the sitting stances, the driver along with the passengers may encounter different impacts while driving [18, 45]. The impact might be diminished by altering the seat and the position of the seat. Considered the impact of autonomous and manual driving on comfort in two stances that could be utilized at Level 3-4 self-sufficiency and the impact of giving a neck rest [46]. The investigation is completed utilizing the CATIA software [47-48]. Appraisal like RULA, REBA, and so on are led and the outcomes are seen with the standard life systems [49]. Various parameters are considered during these observations like fit parameter, feel parameter, support parameter, etc. [50]. The result will manage the investigation of different unique parameters of seat cushions and suspensions along with improving strategies for seat transmissibility [51].

1.6 Objectives

The objective of this study is:

- To make a conceptual design of a cycle rickshaw with average standard dimension in CATIA V5.
- To perform RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment).
- To suggest a more comfortable design for driver seats in cycle rickshaws after evaluating the action levels.
- To fabricate the designed modified seat.
- To perform vibration analyses to ensure that the practical experiment can justify the development of the seat design.

The introduction of this study represents a general knowledge of ergonomics and its importance while highlighting the importance of ergonomics in enhancing human well-being, safety, and performance, particularly focusing on vehicle design. It emphasizes creating comfortable and user-friendly environments, highlighting the role of seat design in vehicles. The study discusses occupational risk factors contributing to musculoskeletal disorders and suggests strategies to address them, such as job rotation and workstation redesign. It also discusses the evolution of ergonomic tools in vehicle design, emphasizing digital models and manikins. It talks about how to make workplaces and products better for people to use. It focuses on understanding and fixing problems like discomfort or injury that can happen when people work or use things like chairs in vehicles. Using tools like RULA and REBA to check for these problems, and computer programs like CATIA to help find solutions is very common nowadays. It also looks at how to design vehicle seats to make them safer and more comfortable for drivers and passengers. Overall, it's about using technology and understanding people's needs to make things better for everyone.

The literature review discusses the previous works regarding the ergonomic analyses of vehicles. It focuses on the integration of ergonomic principles in vehicle design, particularly emphasizing the significance of factors such as safety, comfort, and efficiency. In some studies, it utilized the CATIA-Ramsis program to conduct comparative analyses of different driver positions in automotive products, both locally and globally. By examining H-point distances and angles during vehicle driving, some studies identified variations in driver positions and proposed adjustments to optimize ergonomic performance. Additionally, some research highlighted the importance of regular ergonomic assessments during the design process and emphasized the positive impact of ergonomic design on production and use in competitive automotive industries.

The CAD design and fabrication chapter brings about the modified seat design suggested for better ride comfort for human-powered rickshaw drivers. The driver's seat design is completed in SolidWorks (Dassault System) as well as is described with all the modifications along with proper explanations. To run an ergonomic analysis, a CAD rickshaw structure model is designed with both conventional and modified seats. Finally, the modified seat is fabricated and set up in the rickshaw model to analyze experimental data.

The Ergonomic analysis chapter explains the ergonomic features of the conventional and modified models to ensure a proper comparison. Right Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) analysis are done to verify the MSD score of both designs. The RULA and REBA score decreases along with the modification of the conventional design. In the conventional system, the RULA and REBA score is found to be 5 and 7 respectively. With the final suggested modified design, the RULA and REBA score is reduced to 2 and 4 respectively. These results indicate a very positive outcome of the analysis.

The vibration analysis chapter is led by the data taken by a vibration meter. A vibration meter is used to measure the input and output response of both conventional and modified models. The rickshaw with a conventional seat design is run over a constant route three times each day for consecutive three days. For the analysis, the structure is considered as a single degree of freedom (SDOF) system. The random vibration provided by the road surface is taken as the input data and the vibration which will be felt by the driver is taken as output data. Similarly, the same analysis is done with the rickshaw with a modified designed driver's seat on the same route for the same duration to ensure that the applied random vibration can be kept identical for both experiments. Finally, the ratio of the output to the input of responses is calculated to compare the models.

The result and discussion enlighten the results found from the analyses as well as show the results with graph plots to provide a visual representation. The result of the ergonomic analysis indicates the positive outcome which states that the modified seat design will be more comfortable than the conventional design. The same statement is also proved from the vibration analysis experiment. The vibration analysis result shows that the response ratio curve of the modified design is lower compared to the conventional response ratio curve. It implies that the modified design will absorb more vibration and its reduced stiffness will ensure more comfort to the driver.

Finally, the conclusion summarizes the study highlighting its outcomes. As well as it opens a window to future modifications that can be done to improve the design further.

Chapter 02

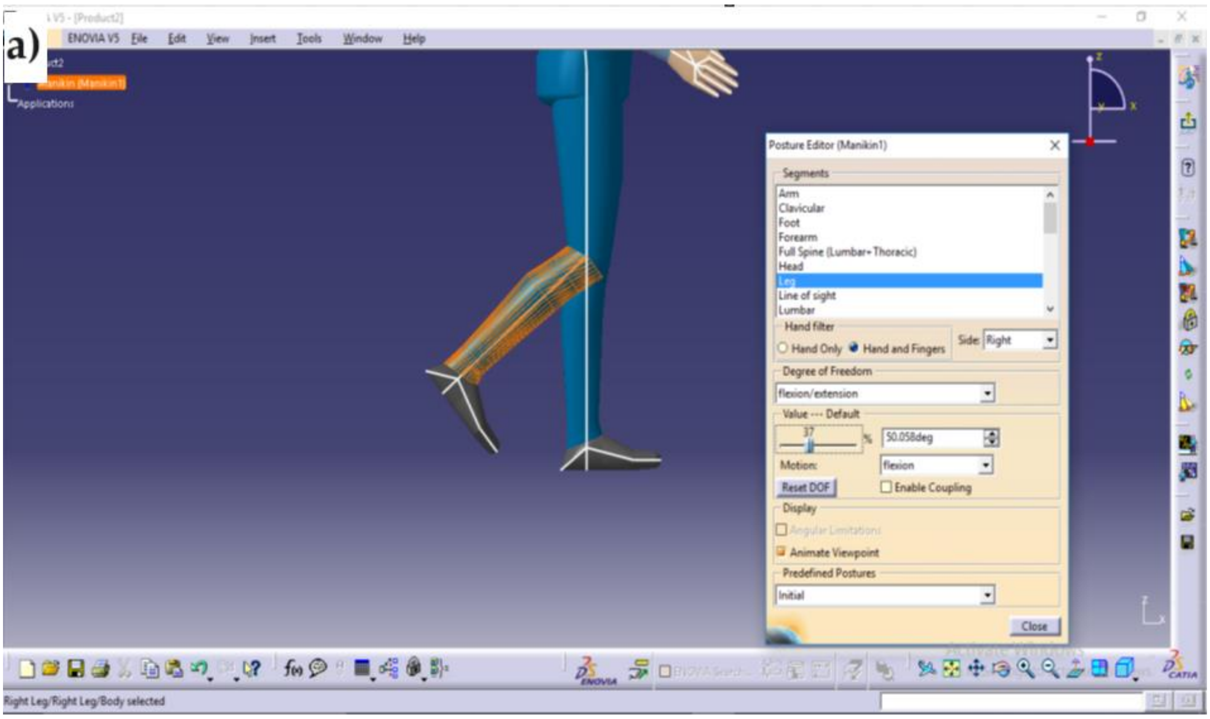
Literature Review

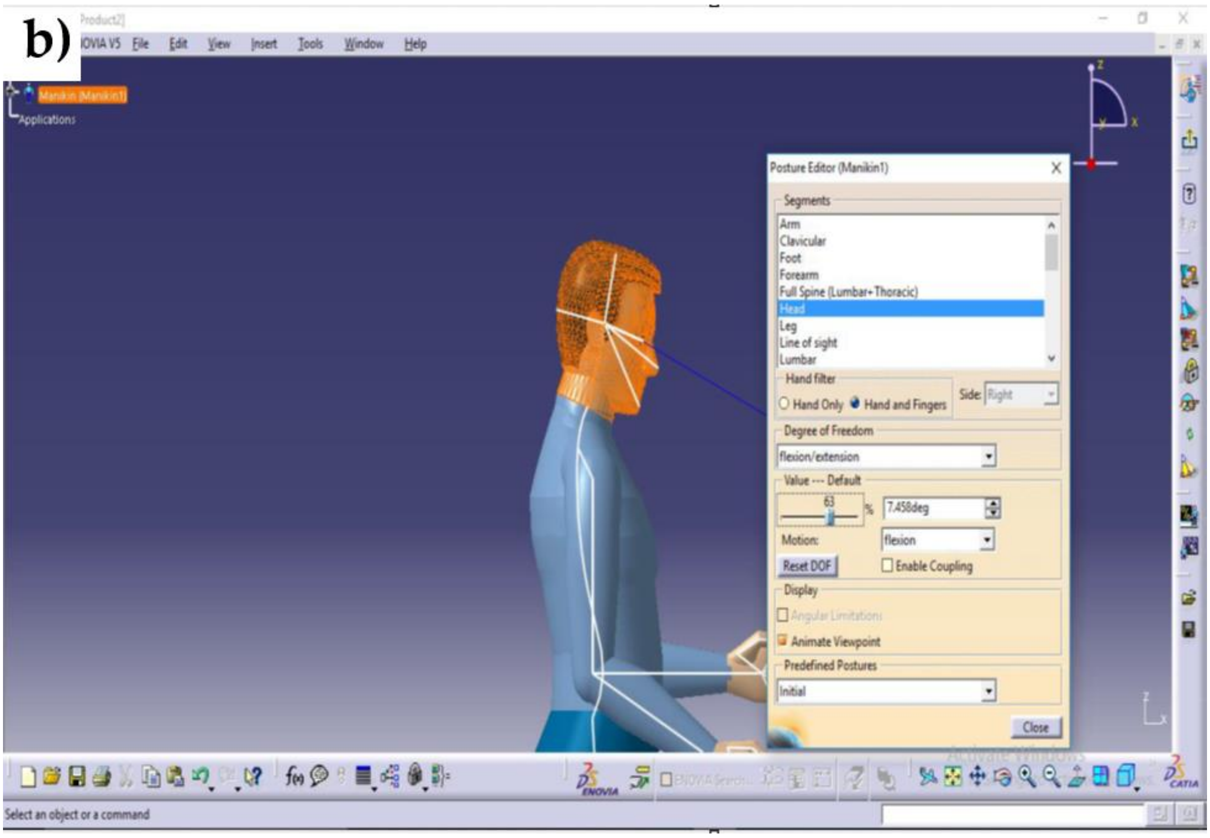
Sivasankaran P. et al [4] emphasized in their study about the disturbance created by human fatigue while doing a repetitive job as fatigue spoils the productivity of workers for the entire day. The main objective of his work was to carry out the work in a well-performed way. The key purpose of using the ergonomics principle was to minimize the musculoskeletal disorder issues faced by the workers everyday time of work. The various analyses carried out related to human ergonomics concerning the human leg, waist, and arm using posture editor tool using CATIA V5 Package. This study focused on the minimization of manual fatigue caused by repeating work. Hence various human postures were analyzed in a 3d virtual human modeling environment by posture editing tools as shown in figure 2.1. Finally, it was compared with the actual data to determine the range of variation. The study demonstrated the ergonomics analysis of the leg, waist, and right arm of a 3D digital human model in a workspace environment as well as compared the resultant and actual values as shown in table 2.1 [4].

Table 2. 1: Comparison of different ergonomics parameters using observed data and standard data (Adapted from [4]).

S. No	Item List	Standard data (Deg)	Observed data (Deg)
1	Leg lifting angle	52.5	20.05
2	Waist angle	75	69
3	Side adjustment of arm	54.5	49.16
4	Neck movement	10	7.45

X. Gao et al. [52] made a comprehensive study that delves into the increasing importance of ergonomics in the design of farm machinery, especially within the context of the evolving agricultural economy. It recognizes the transformative impact


a)
Posture Editor (Manikin1)
Segments
Arm
Clavicular
Foot
Forearm
Full Spine (Lumbar+Thoracic)
Head
Leg
Line of sight
Lumbar
Hand filter
Hand Only
Hand and Fingers
Side: Right
Degree of Freedom
flexion/extension
Value --- Default
50.058deg
Motion:
flexion
Reset DOF
Enable Coupling
Display
Animate Viewpoint
Predefined Postures
Initial
Close
Right Leg/Right Leg/Body selected


b)
Manikin (Manikin1)
Applications
Posture Editor (Manikin1)
Segments
Arm
Clavicular
Foot
Forearm
Full Spine (Lumbar+Thoracic)
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Leg
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Reset DOF
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Display
Angular Limitations
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Predefined Postures
Initial
Close
Select an object or a command

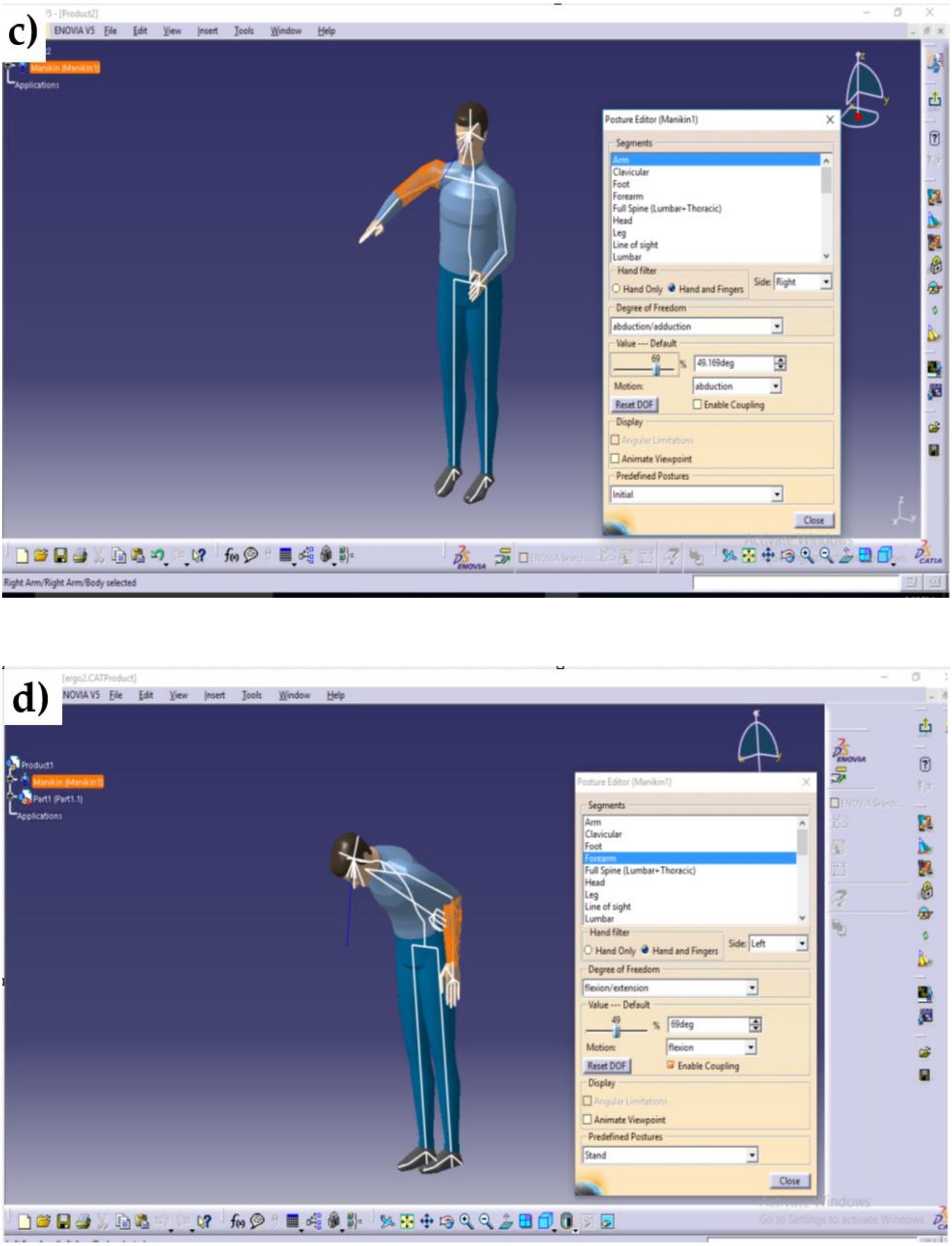


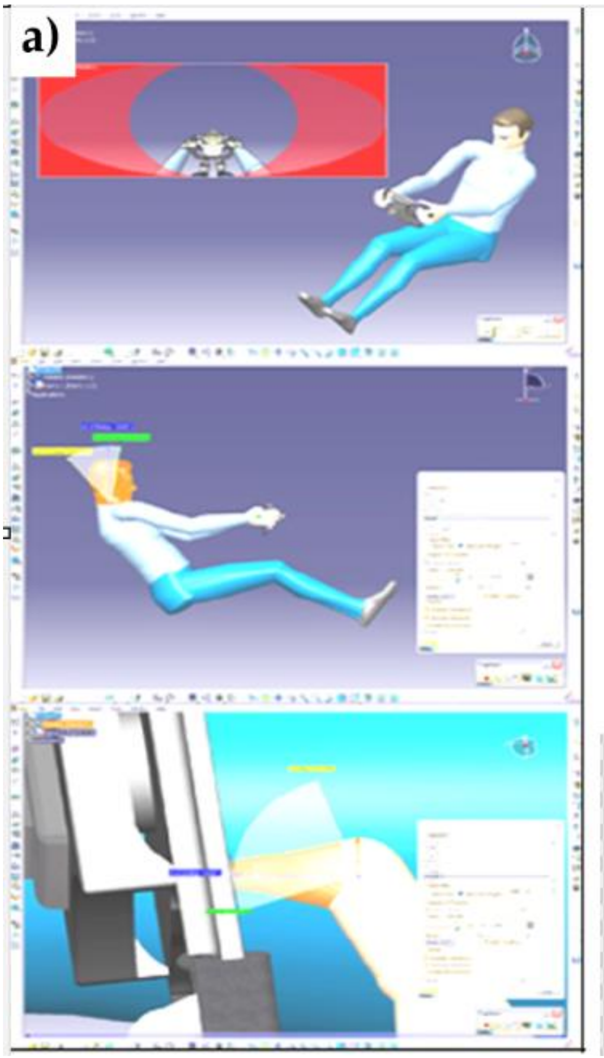
Fig. 2. 1: Posture analysis of (a) leg, (b) head, (c) arm, and (d) forearm in CATIA human builder (Adapted from [4])

of computer-aided design on farm machinery, making it more intuitive, flexible, and convenient. However, the study highlights a crucial gap in existing computer-aided ergonomics software for farm machinery design in China—the absence of suitable human body databases, leading to deviations in ergonomics analysis. To address this issue, the paper proposes a solution involving the utilization of CATIA's open database interface procedure to establish a dedicated human body database specifically tailored for farm machinery design. By integrating human body data into CATIA's ergonomics module, the study advocates for the creation of practical virtual bodies as shown in figure 2.1. This approach allows for an analysis of ergonomics in farm machinery, leveraging modules such as human posture and activity analysis. The overarching objective is to realize a computer-aided farm machinery designing method firmly grounded in engineering principles. The study recognizes the pivotal role of farm machinery in driving agricultural economic development but underscores a prevalent issue—many products prioritize functionality over user considerations, resulting in safety and comfort challenges. While acknowledging the advancements in ergonomics design, particularly with the integration of computer-aided technology and the maturity of overseas simulation methods, the study contends that a tailored ergonomics design system is necessary in China. This system should account for the unique characteristics of the local population, emphasizing the need to consider regional and seasonal variations in human body size data. The study sheds light on the Chinese standard GB/T10000-1988, which categorizes human body data into five regions, aiding designers in selecting size data based on the intended use region of the machinery. It emphasizes the importance of incorporating regional and seasonal human body size data to ensure operator comfort and efficiency. The core technological focus of the study lies in CATIA V5, a high-end CAD/CAM software system. While praising CATIA V5 for offering effective ergonomics analysis tools and methods, the study notes a limitation in its human model—it lacks Chinese human body data in its basic model storehouse. The article's primary thrust is on overcoming this limitation by establishing a virtual body with Chinese human body characteristics through CATIA's open database interface procedure, specifically tailored for farm machinery product design. The study highlights the ability of CATIA V5 to generate high-quality, user-defined human models using advanced anthropometric tools. This involves digitizing human models through relational formulas between body structure metric data and height, body weight, allowing for simplified input data. The resulting database files adhere to CATIA's rules and are seamlessly integrated into the CATIA human body size database. Subsequently, relevant human body size data is incorporated into the CATIA ergonomics module, utilizing the software's human body roll-in function to create a virtual body that supports human-machine analysis for farm machinery products.

In summary, this study provides a thorough exploration of a computer-aided farm machinery product design method with a central focus on ergonomics. By addressing the need for localized human body databases and incorporating regional and seasonal considerations, the study aims to contribute to the realization of farm machinery designs that prioritize both user comfort and operational efficiency. The use of CATIA V5, coupled with the proposed methodologies, presents a comprehensive approach to achieving this goal in the context of the evolving agricultural landscape in China.

H. O. Demirel et. al. [39] studied the exploration of the integration of Digital Human Modeling (DHM) and Product Lifecycle Management (PLM) software in the development of a Formula 1 race car and a marine vessel. Using Dassault Systems' CATIA V5 for design and UGS Tecnomatix JACK for ergonomics, the study demonstrates the potential of DHM-PLM integration to enhance product development, especially in systems with human-machine interactions. The literature review indicates future research possibilities, such as simulating blast motion in Navy vessels, affirming the promising role of DHM in PLM for advancing simulation capabilities in complex scenarios [15, 53]. The combination of Digital Human Modeling (DHM) applications with Product Lifecycle Management (PLM) solutions yields substantial benefits in product development and digital manufacturing. Research by CIM data indicates that organizations integrating DHM and PLM can achieve significant reductions, including a 30% decrease in lead time to market, a 65% cut in design changes, and a 40% reduction in time spent on manufacturing planning. Moreover, this integration can lead to a 15% increase in production throughput and a 13% decrease in overall production costs [1]. Product Lifecycle Management (PLM) is a strategic approach that integrates managerial and engineering aspects to manage the entire product lifecycle, emphasizing collaboration across different enterprise segments. PLM ensures consistency in business solutions from concept creation to end-of-life management. This paper advocates for considering human-machine integration and ergonomics in complex product development, promoting the use of Digital Human Modeling (DHM) for PLM applications. The application of DHM tools, exemplified by Ford Motor Co.'s use of the JACK human simulation solution, is highlighted for its ability to enhance product quality, minimize design changes, and improve safety by addressing ergonomics issues early in the design process. This study investigates the integration of Digital Human Modeling (DHM) and Product Lifecycle Management (PLM) tools in the development of a Formula 1 race car and a marine vessel. Using Dassault Systemes' CATIA V5 for CAD/CAE design and analysis, and UGS Tecnomatix Jack for visual/mathematical ergonomics and human analysis, the authors detail the design methodology and DHM strategies. In the Formula 1 race car design, CATIA V5 is employed for CAD modeling, mechanical integrity testing, and ergonomic design. The integration of UGS Tecnomatix Jack allows for further assessment of driver comfort through mimicking driving postures and using the Comfort Assessment module. The dual validation method, combining virtual and mathematical analyses, ensures a comprehensive evaluation of design objectives, optimizing driving standards and comfort. The study emphasizes the significance of integrating DHM and PLM for enhanced product development, illustrated by realistic rendering effects applied to the complete CAD model.

The study explores the application of Digital Human Modeling (DHM) and Product Lifecycle Management (PLM) integration in the design of a Formula 1 race car and a marine vessel as shown in figure 2.2. Using CATIA V5 for CAD/CAE design and UGS Tecnomatix Jack for DHM, the Formula 1 car design involves comprehensive CAD modeling, mechanical integrity testing, and ergonomic optimization for driver comfort. The integration allows for virtual assessment of driving postures and comfort analysis. The methodology employed in the Formula 1 car design is proposed for addressing design and analysis challenges in marine applications.



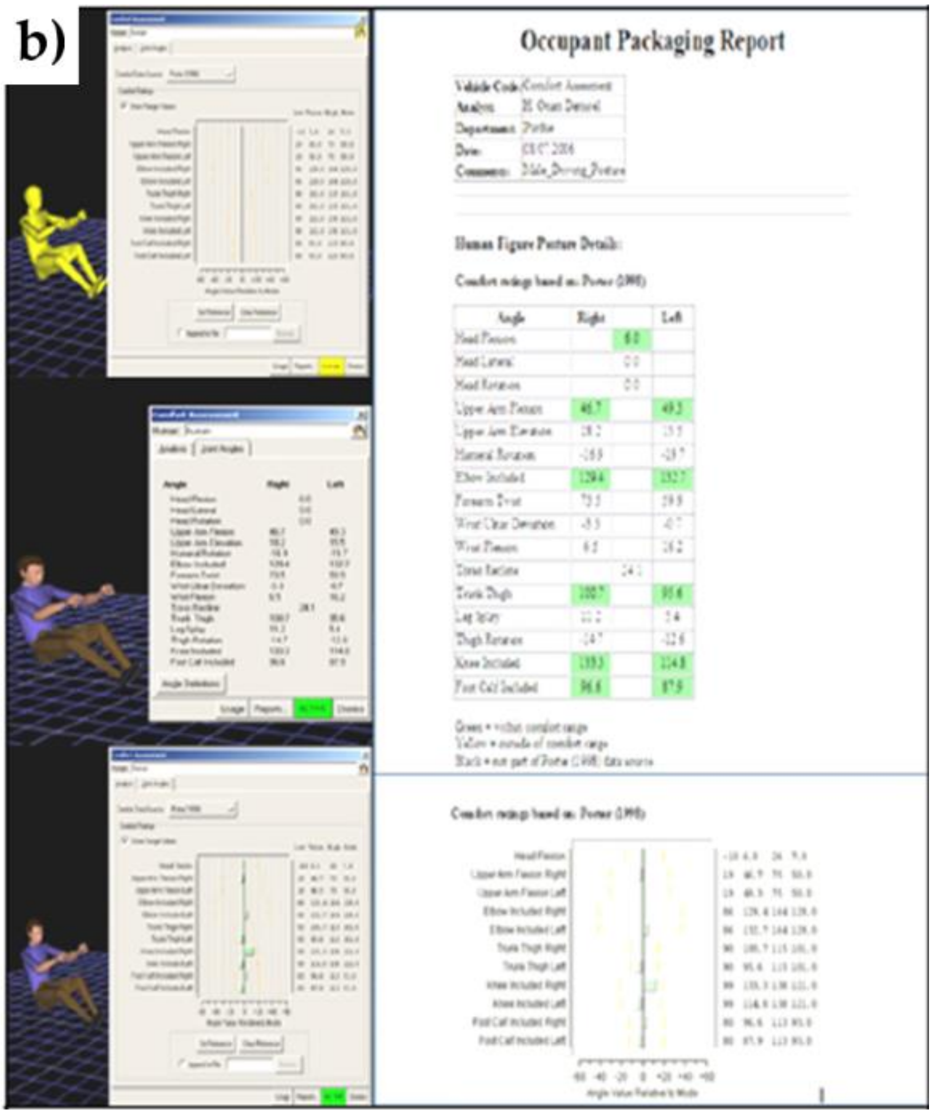
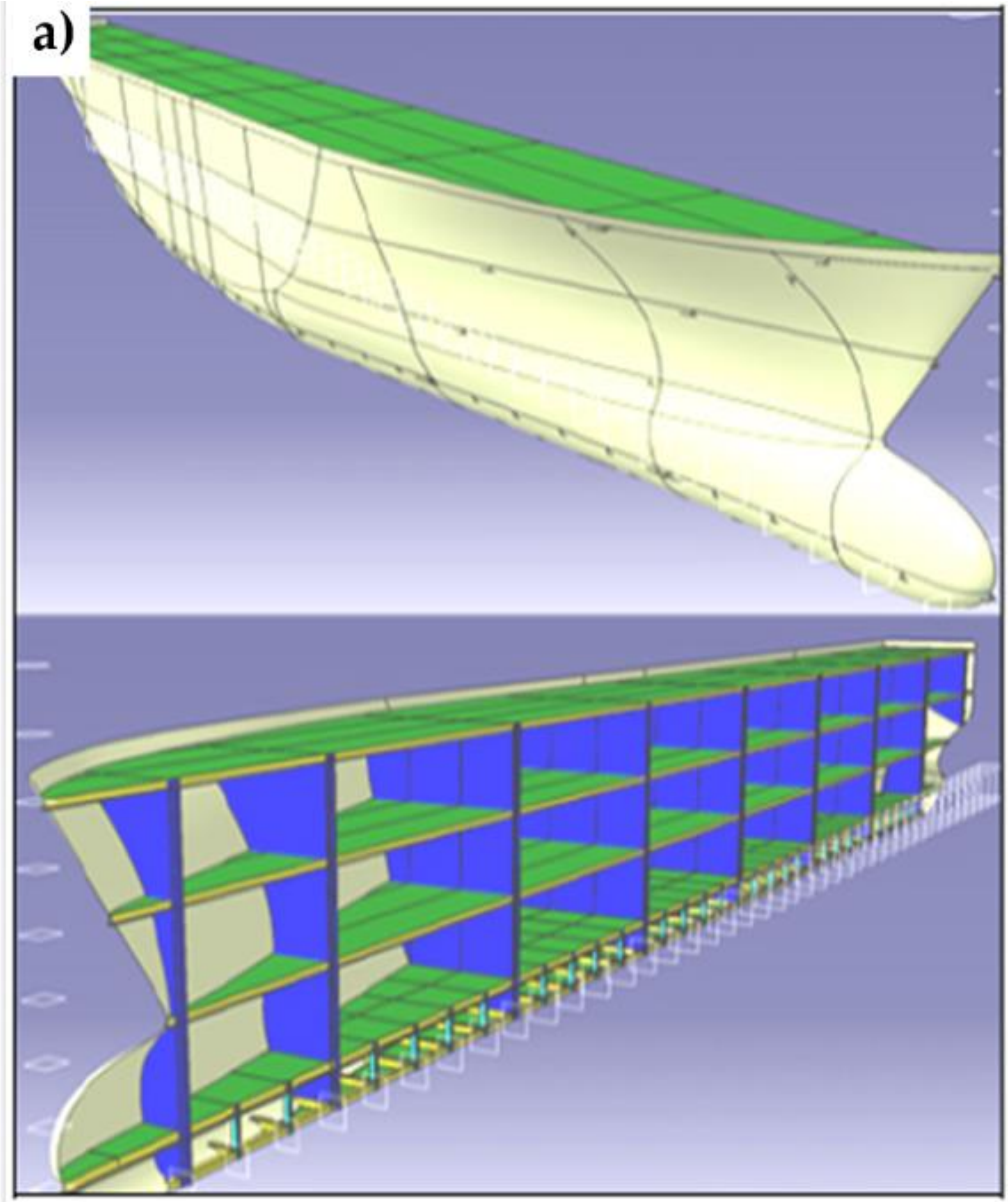


Fig. 2. 2: DHM virtual design and driver comfort analysis (Adapted from [39])

The paper discusses the use of DHM applications in enhancing the design, analysis, and simulation needs of marine vessels, particularly focusing on mitigating the threat of underwater shock caused by explosions. A lumped parameter model is employed to simulate impact forces on the human body during a shock, allowing for the identification of critical areas and investigation into structural influences. A parallel approach is then applied to naval vessel design, mirroring the Formula 1 car methodology shown in figure 2.3. CATIA V5 is used for CAD modeling, Generative Structural Analysis for testing mechanical integrity, and an ergonomics design and analysis workbench for visual confirmation of human model interactions. The integration extends to JACK software for walking simulations and task simulations with loads, ensuring practicality and ergonomic considerations in naval vessel design and analysis [15].



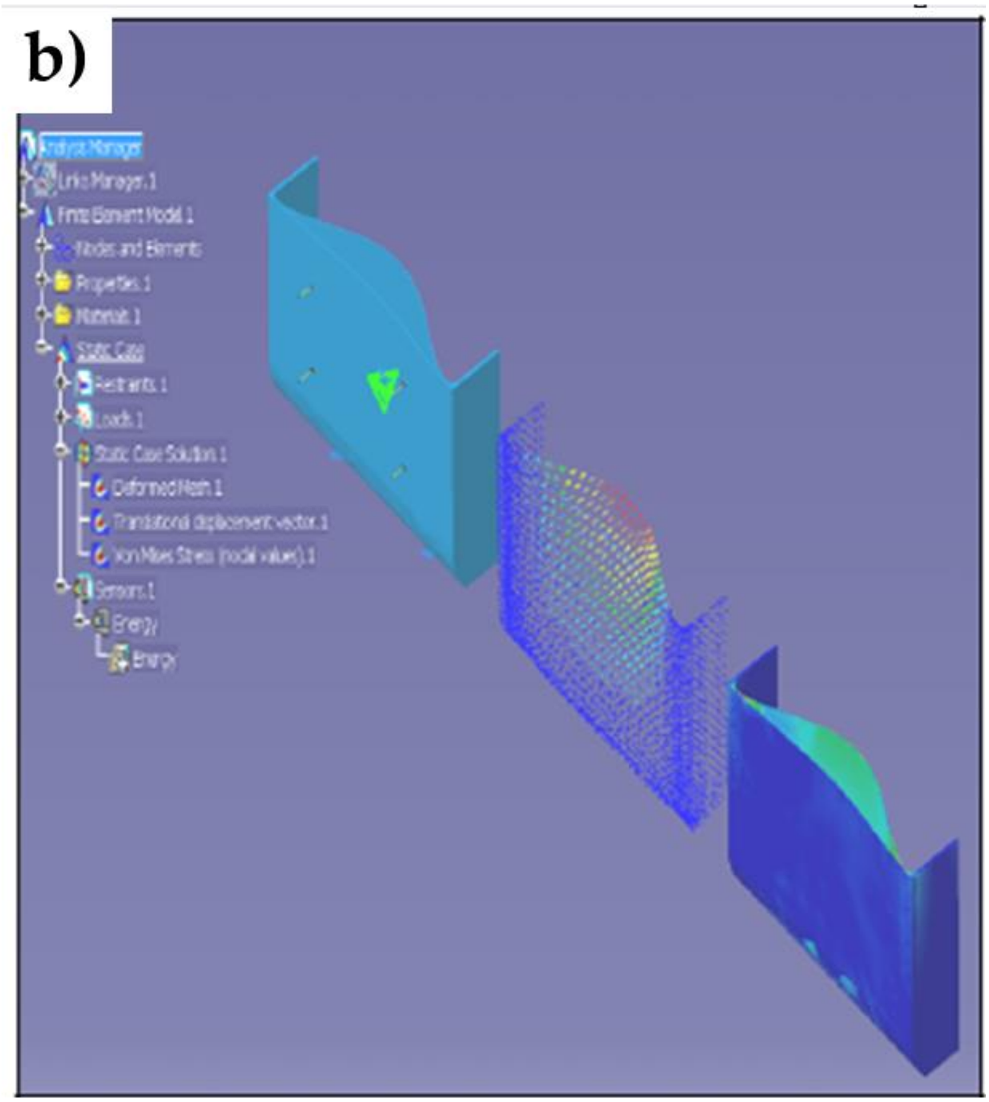


Fig. 2. 3: CAD modeling and structural analysis (Adapted from [39])

The study highlights the integration of CATIA V5's design and analysis tools with JACK software in Formula 1 race car design, demonstrating improved speed, quality, and safety through driver comfort analysis. The approach is proposed for marine vessel design, emphasizing the lumped parameter model's effectiveness in simulating blast motions. Integration of CATIA V5's Structure Detailed System/Object Design with dynamic DHM packages is suggested for enhanced ship structure design. The paper underscores the strength of PLM in addressing engineering challenges and DHM's impact on improving ergonomics, safety, and human factors. The integrated DHM and PLM approach is deemed a common solution for complex product development challenges, offering pre-production simulations for advanced vehicles.

Y. Wu [48] focused on the importance of ergonomic design in Formula Student Electric (FSAE) racing, where the driver's control of the car significantly impacts the driving experience. The research specifically examines the blade racing car of the Wuhan University of Technology Formula E racing team (WUTE). The study involves simulation analysis of the car's ergonomics, utilizing real human body data from racers to establish a model. CATIA software's ergonomic design and analysis module is employed to create a human-machine relationship using the human body model as a reference. The study establishes relative relationships between the single shell, seat, steering wheel, and pedals to determine optimal human body posture and visual field. Through constant adjustment and verification of key rules, the research aims to define an appropriate man-machine relationship as a benchmark for racing car design in terms of ergonomics. The Formula SAE (FSAE) competition, organized by automotive engineering societies at universities, involved students designing and manufacturing automobiles. Recent research in this field used advanced technologies like computer-aided design and human body model simulation analysis to study cab adaptability based on man-machine engineering theory. Scholars explored driver posture, operating comfort, and field of vision using CATIA software. However, existing research tended to overlook the impact of ergonomic positions on crucial vehicle parameters, focusing more on seats and instruments. This paper aimed to bridge this gap by integrating man-machine engineering principles with CATIA simulation to optimize important vehicle parameters. The goal was to enhance the rationality of FSAE vehicle design, considering both ergonomic factors and their influence on overall vehicle layout. The study aimed to bring performance benefits through the adjustment and optimization of key parameters, contributing to a more comprehensive understanding of the relationship between ergonomics and vehicle design in the context of Formula SAE racing cars. Ergonomics, as a multidisciplinary subject, involved the coordination of human, machine, and environment in various operations, with its primary goal being the design for optimal compatibility between the driver and the car. In compliance with the Formula China 2020 rules, the car had to accommodate a male driver ranging from the 5th percentile to the 95th percentile. Specific requirements included ensuring that the male 95th percentile template position and template head met certain criteria. For instance, there had to be a minimum distance of 50.8mm (2 inches) between the top of the front ring and the top of the main ring. Additionally, if the diagonal brace of the main ring was positioned behind, there had to be a minimum distance of 50.8mm between the top of the main ring and the bottom of the diagonal brace, ensuring proper clearance for the helmet. Through data query, comparison, and analysis, the study determined the comfortable angles of each joint for FSAE racers as shown in figure 2.4. These angles served as reference values for design considerations, including an ankle joint angle of 93°, knee joint angle of 150°, hip joint angle of 45°, waist joint angle of 15°, trunk joint angle of 38°, shoulder joint angle of 9°, elbow joint angle of 143°, and neck joint angle of 20° as described in table 2.2.

The study involved measuring various parts of the human body to assess individual and group differences in body size, aiming to understand human morphological characteristics for improved product design. Due to space limitations, the focus was on static shape parameters, and measurements were taken in a sitting position for simplicity. The required height, upper arm length, forearm length, thigh length, calf length, and other data were measured using common tools such as a body altimeter, angle gauge, and medical weight scale. The collected data were processed and mean, and standard deviation were calculated. Percentile, a positioning index in anthropometry, was determined empirically. To account for the lack of a Chinese standard human body model in CATIA software, the study used the Taiwan human body model, with the corresponding percentage P calculated based on average height data. Comparing the 82.14 percentile human body model in CATIA with the team driver's actual data revealed an error of less than 10%. Despite potential measurement errors, the model was considered representative of the team driver's actual situation. CATIA V5, a CAD/CAM software developed by BM/PS based on Windows core, played a crucial role in addressing the relationship between people, machinery, and the working environment in product design engineering. In the context of human-machine design and analysis, CATIA V5 introduced a solution, featuring a human body model within its software containing 104 sets of measured data and over 100 unconstrained connections. This model was frequently utilized for visual field analysis, sitting position analysis, and angle analysis of motion comfort. To adapt the 82.14% percentile mannequin derived from WUTE drivers' mean data into a single shell design adhering to race rules, CATIA was employed.

Table 2. 2: FSAE driver's joint comfort angle (Adapted from [48])

Joints	Comfortable Angle / (°)	Joints	Comfortable Angle / (°)
A1	90~95	A5	32~40
A2	148~162	A6	5~9
A3	42~47	A7	100~125
A4	10~15	A8	5~7

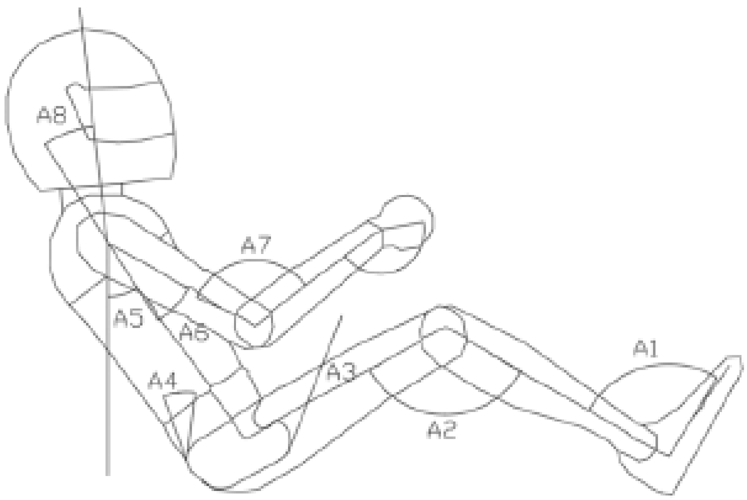


Fig. 2. 4: Joint angle and marking (Adapted from [48])

The "Human Builder" function in the "Ergonomic Design and Analysis" module facilitated the insertion and adjustment of the mannequin to align with the monomer shell's space and safety requirements. The "Posture Editor" fine-tuned the mannequin's torso, limbs, and joints based on Table 1 data, ensuring a suitable relative position with the monomer shell. Subsequent to the initial adjustment, the human body posture underwent evaluation using the "Human Activity Analysis" module in CATIA, incorporating RULA Analysis function. The results indicated a comfortable pose for the current mannequin as shown in figure 2.5. Further analysis using "Open Vision Window" assessed the visual field, confirming extended vision along the furthest surface of the single shell. This enhanced visibility contributed to the driver's advanced understanding of the track, offering increased fault tolerance. The left and right field of vision observations provided crucial insights for optimal steering conditions. To ensure compliance with race regulations, the positioned model underwent substitution into the simplified 2D model required by the regulations for the 95th percentile. It was then restrained by the trunk body frame to confirm adherence to regulations. The design not only met race regulation requirements but also allowed for appropriate reduction in the main ring's height. Subsequent assembly and analysis addressed interference issues between different systems and components, contributing to the overall optimization of the design. In the realm of FSAE vehicle design, this study advocates for the integration of man-machine engineering simulation and design using CATIA software. The proposed approach entails parameterizing the car driver, adjusting their posture, and determining the optimal locations for critical data and related components. This methodology has proven to be efficient in reducing the time and effort required during the design phase, specifically in addressing issues with crucial vehicle systems such as the front ring, main ring, steering wheel, instrument, and pedal positions. Moreover, the paper presents detailed data on the ergonomics of FSAE racing cars, including the angles of each joint when a driver lies down. This data aligns with the specific design requirements of FSAE racing cars, establishing a robust evaluation system for ergonomics. The successful integration of ergonomics with vehicle layout, along with macroscopic control over vehicle configuration, significantly contributes to enhancing overall vehicle performance.

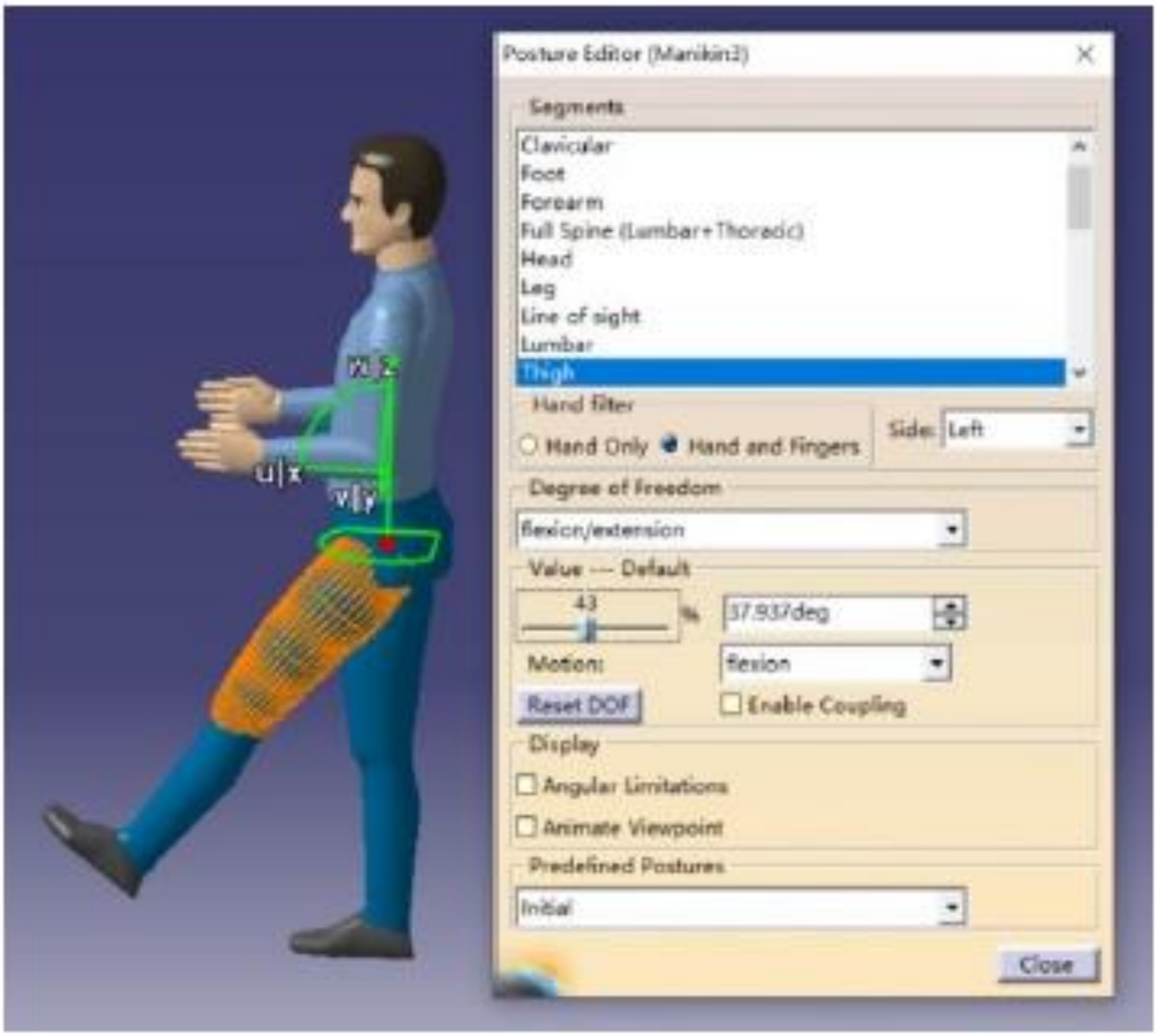


Fig. 2. 5: CATIA posture adjustment (Adapted from [48])

In the study done by M. N. Abidi et. al [54] the design of the car has been analyses along with its ergonomic design. Over the past decade, there has been a notable surge in attention towards human factors in the design, engineering, production, and maintenance of industrial products, particularly within the automotive industry. Recognizing the critical role of ergonomic quality in product success, the integration of virtual reality (VR) techniques has become increasingly prevalent throughout various stages of product development. In a specific research endeavor focused on the automotive sector, a pioneering study was conducted to perform an ergonomic assessment for the first Saudi Arabian car. The research utilized the CATIA V5 human builder module to create virtual humans representing American males at the 50th and 95th percentiles as shown in figure 2.6. These virtual human models were instrumental in carrying out ergonomic analyses on a digital prototype of the car, serving as a substitute for the traditional approach of constructing physical prototypes.

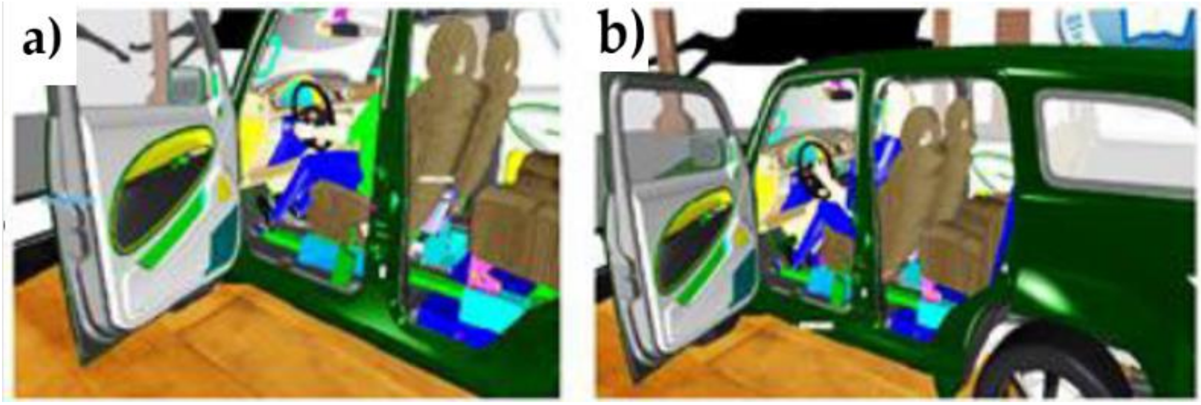


Fig. 2. 6: Distance between driver's seat and rear seat for (a) 50^{th} percentile and (b) 95^{th} percentile (Adapted from [54])

By employing VR technology, the study successfully reduced the need for expensive and time-consuming physical prototypes. This shift towards virtual validation allowed for an early-stage assessment of the project, facilitating a comprehensive ergonomics evaluation within a semi-inversive virtual environment. The research not only demonstrated the practical application of VR techniques in ergonomic analysis but also underscored their efficacy in advancing the development of automotive products. The integration of virtual humans in the assessment process marked a significant step toward enhancing the overall ergonomic quality of the Saudi Arabian car, aligning with the industry's evolving emphasis on human-centered design principles. In the past, the development of the Gazal-1, the inaugural Saudi Arabian-designed passenger car, incorporated a thorough ergonomic analysis to enhance its comfort, safety, and customer appeal. The Gazal-1, an SUV built on the Mercedes-

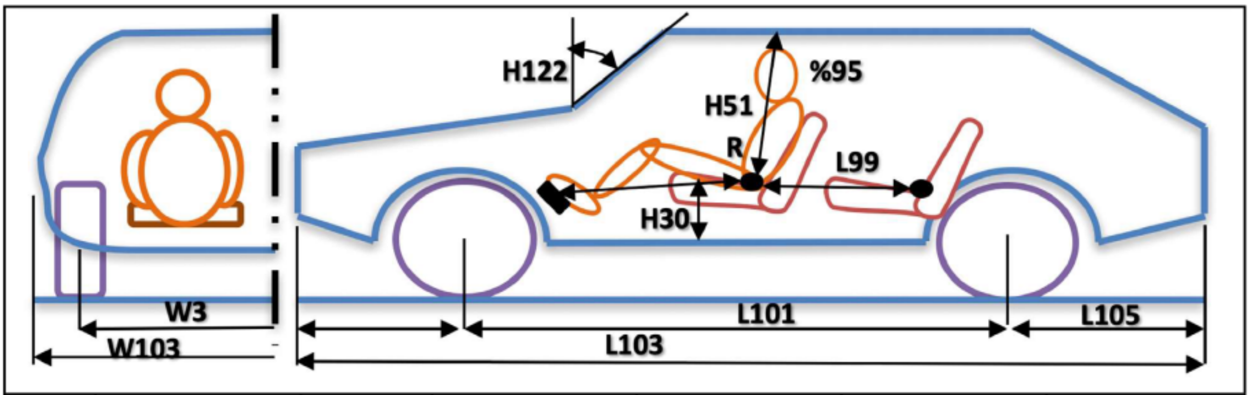
Benz G-Wagon platform, derived its name from a desert deer and measured 4.8 meters in length and approximately 1.9 meters in width. Following the creation of the car's Computer-Aided Design (CAD) model, a decision was made to conduct ergonomic assessments within a semi-immersive virtual environment. This innovative approach aimed to save time and costs associated with physical prototype development, providing designers with increased flexibility for various tests and design analyses. The study found that the virtual prototype of Gazal-1 closely resembled the real car, suggesting its accuracy for ergonomic analysis. The development process involved building CAD models of the car in CATIA, creating virtual humans using the Human Builder module of CATIA V5, and transferring the assembled models to Pro-e for compatibility with Product View adapters. The hardware setup included a Dell Precision computer for graphics generation, a Christie Mirage projector for rear-side projection on a screen, active stereo shutter glasses for participants' stereoscopic viewing, and an Intersense IS-900 Motion tracking system for head and hand tracking. The participants interacted with the virtual model through a hand wand. The system architecture comprised four major modules: CAD System, Translation System, Input System, and Output System. These modules collectively facilitated the creation, translation, input handling, and 3D visualization of the virtual environment. For ergonomic analysis, CATIA V5 R22 Human Builder module was utilized to create digital human models representing 50th and 95th percentile American males. Anthropometric data for these models were based on standard Society of Automotive Engineers (SAE) J1100 specifications. Ergonomics analysis focused on factors such as seating position, steering wheel adjustability, gear shift accessibility, pedal positioning, leg room, and headroom.

The study emphasized the importance of considering various human dimensions, particularly in sitting postures, for optimizing car interior design. Virtual humans provided a flexible means for analyzing different clearance distances in the virtual environment, enabling designers to explore a variety of scenarios that may not be feasible with real test persons and physical mockups. The semi-immersive virtual environment proved to be an effective tool for accurate and efficient ergonomic assessments in the early stages of Gazal-1's development.

In recent years, the automotive industry emphasized ergonomics in vehicle design, leading to a successful ergonomics analysis of the Gazal-1, the first Saudi Arabian-designed car, within a cost-effective and time-efficient semi-immersive virtual environment. The study highlighted enhanced comfort and safety features for the 50th percentile human, showcasing the advantages of virtual reality-based systems over traditional CAD approaches. The integration of virtual humans allowed for a broader exploration of designs, offering a global perspective on man-vehicle interaction. Future work may involve sophisticated hardware for complex ergonomics assessments.

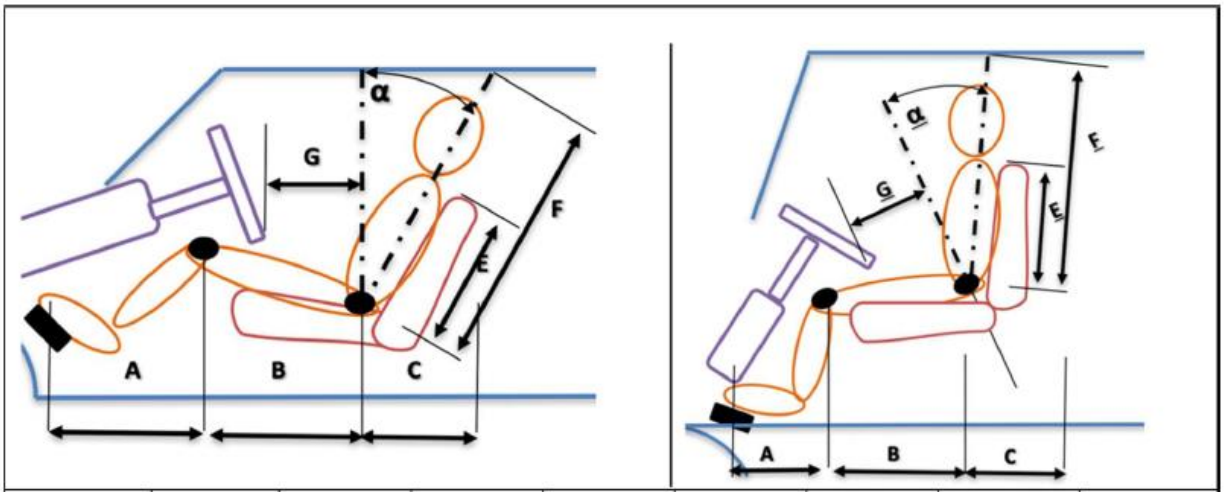
The research done by F. A. Paker [44] emphasized the paramount importance of ergonomic considerations in the development of vehicles. The seating position, characterized by variables such as safety, comfort, cost, customer preferences, and vehicle dynamics, played a pivotal role in shaping the anatomy and structure of vehicles. The H-Point, representing the driver's height from the ground, was identified as a critical factor in the early stages of automotive concept design, influencing aspects such as visibility and wind resistance. Ergonomic decision-making and analysis methods were integral components of the automotive design process, determining both the structural proportions of the vehicle and guiding subsequent analyses and studies. The interdisciplinary nature of ergonomics, spanning anatomy, medicine, psychology, and physiology, was underscored, particularly in fields like industrial design, automotive concept design, and industrial design engineering. Safety considerations were paramount, with elements influenced by the driver's position—such as the angle of view, steering wheel diameter, and instrument panel ergonomics—directly impacting safe driving. The automotive industry was identified as a critical area for ergonomic designs, as non-ergonomic designs were found to contribute to issues ranging from driver discomfort to musculoskeletal problems and potential vehicle accidents. The study highlighted the need for computer-aided programs to analyze driver positions, providing valuable insights for optimizing expected driver usage performance. Overall, the incorporation of ergonomic principles in automotive design was deemed essential for creating not only comfortable and safe vehicles but also for enhancing resource efficiency and streamlining the new product development process. In the conducted study, 60 product development managers from both local and global automotive industries actively participated in field research. The research focused on examining and comparing six different driver positions of currently produced automotive products, with a specific emphasis on the H-Point, a crucial parameter in vehicle design. The measurements and comparisons were conducted using the 3D CAD Catia-Ramsis program as shown in figures 2.7 and 2.8. Through one-on-one interviews, the methods employed by managers involved in the design of the six vehicles were evaluated. The research methodology, centered around comparative analysis, aimed to address issues identified through the analysis of driver posture positions. Digital comparisons revealed variations in seat angle positions, as well as the steering wheel or instrument panel areas, and H-point positioning. Measurements were carried out at a 90-degree seat angle to ascertain the varying scores of driver positions in different vehicle applications. Interior and exterior reference points, along with seat height, played a crucial role in determining these scores. The study demonstrated that interior and exterior dimensions of the vehicle significantly influenced the driver's position and H-point. Additional factors, such as H-point height, angles, and seat widths, were included in a comparison table to derive the final score. The final value, obtained by combining comparison scores and activity intensity scores, provided a comprehensive assessment of the ergonomic performance of driver positions.

The comparison analysis aimed to reveal potential musculoskeletal problems in vehicle use, evaluating proportion sizes in driving positions and their impact on the driver. Analysis model inputs, including driver H-point, head clearance values, and field of view values, served as performance targets for ergonomic considerations in driver positions. The study highlighted eight distinct sections in the basic vehicle structure, representing different angles and zones that define the driver's position. The comparison measurements focused on vehicles with common internal structure assemblies, all equipped with automatic transmission and the lowest-level multimedia screens. Adjustments made for the company LC3 in the comparison structure, such as removing seat gear and brake-gas kits, aimed to align with real-world conditions and preferences, considering the increasing popularity of automatic transmission vehicles in recent years.



cm	GC1			GC2		GC3			LC1			LC2			LC3		
	B	C	D	C	D	B	C	D	B	C	D	B	C	D	B	C	D
L101	254	254	269	270	276	263	245	252	257	280	304	234	252	260	234	247	252
L103	440	440	479	443	472	491	374	404	442	474	511	362	400	443	265	399	457
L105	95	95	108	99	111	119	69	77	101	113	121	61	72	98	52	71	109
L99	190	190	194	190	190	190	177	181	186	191	196	183	183	189	180	184	200
W103	170	170	178	170	175	185	161	169	188	174	199	154	186	170	156	166	170
W3	135	125	144	136	138	148	132	126	136	142	157	128	136	139	127	136	140
H30	28	28	29	26	25	29	27	27	24	25	27	26	27	29	28	28	27
H51	96	96	97	97	98	97	96	97	97	98	99	95	99	99	94	97	97
H122	60	60	61	61	58	62	58	60	57	57	58	54	57	62	55	54	60

Fig. 2. 7: Driver position of global (GC) and local (LC) automotive companies (Adapted from [44])



mm	ά	A	B	C	D	E	F	G
Driver	10-25	450-500	460-500	420-490	420-500	500-560	950-1000	360-400
Seat	-	280-370	480-520	390-420	440-520	540-600	930-1000	380-420

Fig. 2. 8: H-point ergonomics of automobile and commercial vehicle (Adapted from [44])

The study involved comparing driver positions in local (LC1, LC2, LC3) and global (GC1, GC2, GC3) automotive industry products. Differences in H-point distance and angles during vehicle driving were observed between global companies and local automotive products, attributed to factors like gear and multimedia device placement. Numerical analysis indicated varied hip joint angles, with LC1 having the smallest (10.43˚) and GC1 the largest (17.1˚). Deviation analyses suggested adjustments were needed in LC local automotive products' driver positions during the automotive concept design stages. The study proposed adjustments for LC1-2 products, focusing on driver H-point height and gas-pedal distance. For LC2 and LC3, recommendations included adjusting the H-point for optimal visibility. Specific adjustments for LC1 involved the driver's seat backrest tilt angle and footrest. The study highlighted ergonomic deficiencies in automotive design teams, stressing the importance of outsourcing designs and regular ergonomic assessments during design and competitor comparisons. The research underscored the positive impact of an ergonomic design approach on production and use in competitive automotive industries and its potential for accommodating various autonomous driver positions in the future.

In conclusion, the significance of ergonomics in the design of vehicle seats cannot be overstated. It serves as a cornerstone for ensuring the comfort, safety, and overall satisfaction of drivers and passengers alike. By prioritizing ergonomic principles in seat design, manufacturers can mitigate the risk of musculoskeletal issues, fatigue, and discomfort, particularly during long journeys. Additionally, ergonomic seats enhance vehicle control and responsiveness, promoting safer driving experiences. Ultimately, investing in ergonomic seat design not only enhances the well-being and productivity of occupants but also contributes to a more enjoyable and satisfying ride on the road.

Chapter 03

CAD Design and Fabrication

In the conventional design the base of the driver seat of a human powered rickshaw is supported by springs to absorb the vibration. The incorporation of springs in the driver's seat of a rickshaw holds profound significance, contributing to both comfort and functionality as shown in figure 3.1. In the context of a rickshaw, where the driver spends extended periods navigating diverse terrains and roads, the role of springs becomes paramount. These springs serve as a pivotal component in mitigating the impact of bumps, potholes, and uneven surfaces, absorbing shocks and vibrations that would otherwise be transferred directly to the driver's body. The significance of these springs extends beyond mere comfort. They play a crucial role in reducing fatigue and minimizing the risk of musculoskeletal issues for the rickshaw driver. By providing a cushioning effect, the springs help alleviate the physical strain that could result from prolonged exposure to jolts and jarring movements during the vehicle's operation.

Moreover, the inclusion of springs in the driver's seat contributes to enhanced vehicle control. A more comfortable and stable seating arrangement enables the driver to maintain better focus and control over the rickshaw, ensuring a smoother and safer ride for both the driver and passengers. In essence, the incorporation of springs in the driver's seat of a rickshaw not only prioritizes the well-being of the driver but also optimizes the overall driving experience, making it a crucial element in the design and functionality of these versatile and widely used vehicles.

Fig. 3. 1: conventional driver seat design of rickshaw

3.1 Modified Seat Cad Design

The conventional driver seat design as shown in figure 3.3 with a spring setup, while offering some comfort benefits, also comes with certain disadvantages, especially when considering long hours of use and vibration absorption. Here are some drawbacks:

While springs are intended to absorb shocks and vibrations, the effectiveness of a basic spring setup in conventional seats may be limited. Prolonged exposure to uneven surfaces and vibrations can still lead to discomfort and fatigue for the rider. Moreover, conventional driver seats with springs often lack customization options for individual preferences. Drivers have different anatomies and comfort preferences, and a one-size-fits-all spring setup may not address the diverse needs of cyclists, particularly during extended use. As the whole seat structure is based on the spring setup, springs

Fig. 3. 2: CAD design of the modified seat set up.

of the seats can be prone to wear and tear over time. Continuous use, exposure to varying weather conditions, and the accumulation of dirt and debris can impact the functionality of the springs. This may result in diminished shock absorption and reduced overall comfort. In some cases where the driver has a larger weight than average the conventional set-up doesn't perform as enough. Some drivers may experience discomfort or saddle soreness due to the constant movement of the limited springs. This can be exacerbated during prolonged periods of cycling, negatively impacting the overall comfort of the rider.

Hence, the addition of springs can contribute to the overall weight of the driver. It can also absorb more vibrations eliminating discomfort and fatigue during long hours of driving. The modified design comprises of four spring set-ups along with a curvature surface designed to ensure comfort to the driver shown in figure 3.2. The seat has been designed and assembled in SolidWorks. The base material is wood followed by a cushion provided by foam as shown in figure 3.2.

3.2 Cad Design of Cycle Rickshaw

The cycle rickshaw, a ubiquitous and distinctive form of human-powered transport, is a three-wheeled vehicle commonly found navigating the bustling streets of densely populated urban areas. Figure 3.4 shows a conventional human powered rickshaw operated by a rider who pedals to propel the tricycle forward.

Fig. 3. 3: CAD design of a conventional seat

Fig. 3. 4: CAD design of a human powered rickshaw with a conventional seat design.

Fig. 3. 5: CAD design of a human powered rickshaw with a modified seat design.

Cycle rickshaws are an integral part of urban landscapes, embodying a unique blend of tradition, sustainability, and practicality in providing accessible transportation services. For this study, after taking the available measurement of various cycle rickshaw frames using tapes, basic design for the model structure with the conventional seat has been finalized in CATIA V5. However, to complete the whole structure, some parts have been designed separately based on the frame. The modified seat design has also been assembled as shown in figure 3.5 and has been analyzed.

3.3 Fabrication of the Modified Seat

Fig. 3. 6: Rickshaw with fabricated modified seat model

The modified seat design has been fabricated and implemented on a rickshaw to provide clear and practical experimental data. During the fabrication process, the seat base has been made of wood which has been followed by a cushion set-up to ensure comfort of the driver as shown in figure 3.6.

In summary, while the spring setup in conventional driver seats aims to enhance comfort and absorb vibrations, it may not always provide an optimal solution for drivers engaging in extended periods. Hence, considerations for improved customization, maintenance, and enhanced shock absorption mechanisms have been made to address the limitations associated with this design in this study.

Chapter 04

Ergonomic Analysis

4.1 Ergonomics Analysis with Conventional Seat Design

This conventional design has been studied in ergonomic analysis to identify the comfort of the driver based on the seat design and position in CATIA V5 shown in figure 4.1. For ergonomic analysis, anthropometric data and digital human modeling (DHM) have been considered. DHM is a term that designates a software tool that enables the digital model of humans to interact with virtual workplaces or products in a digital CAD environment. The production will be built up in CAD and several tests will be performed to determine its ergonomics suitability by importing a digital human, thus providing a visual representation of the product in use. The size measurements of the digital human model will be based on an anthropometric database, enabling some different models.

There will be some benefits provided by DHM:

- Will be easy to adopt a proactive design approach.
- Will enable numerous alternative solutions to be compared.
- Will be easy to test a range of different measurements across different data.
- Will visualize the proposed work design layout and its effects on physical ergonomics.

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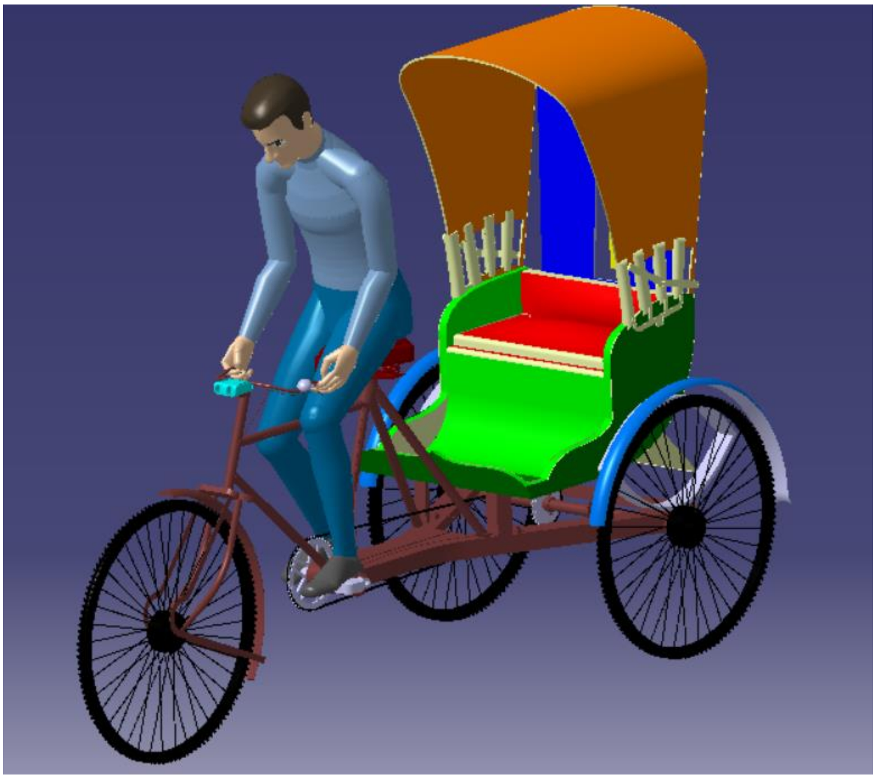
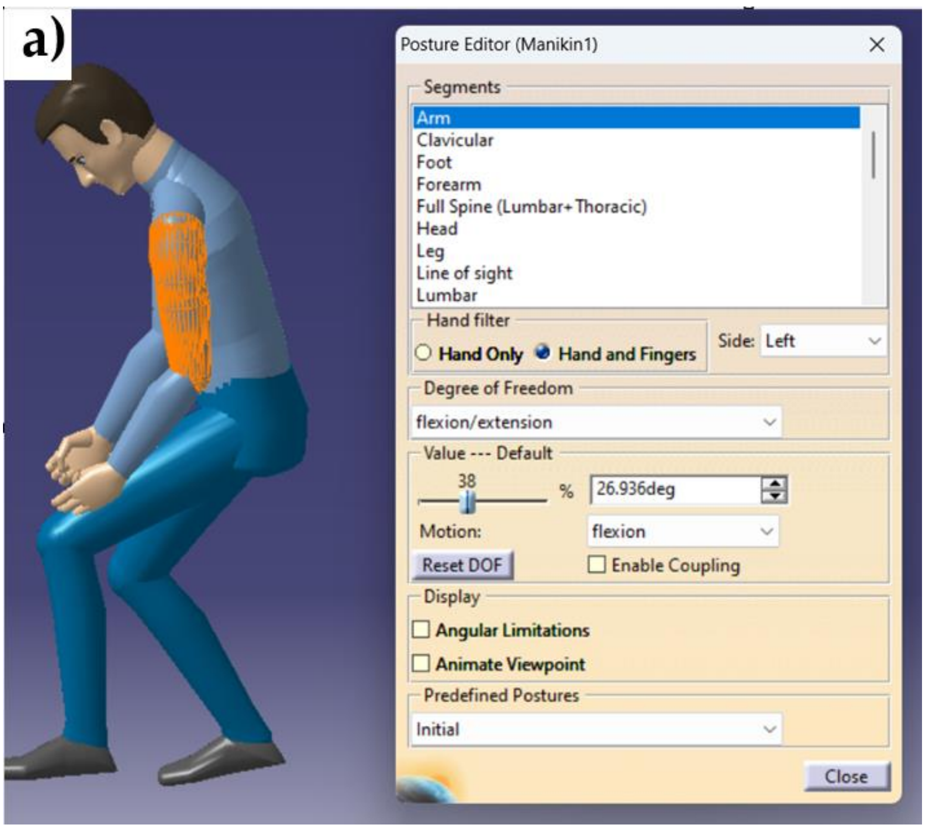
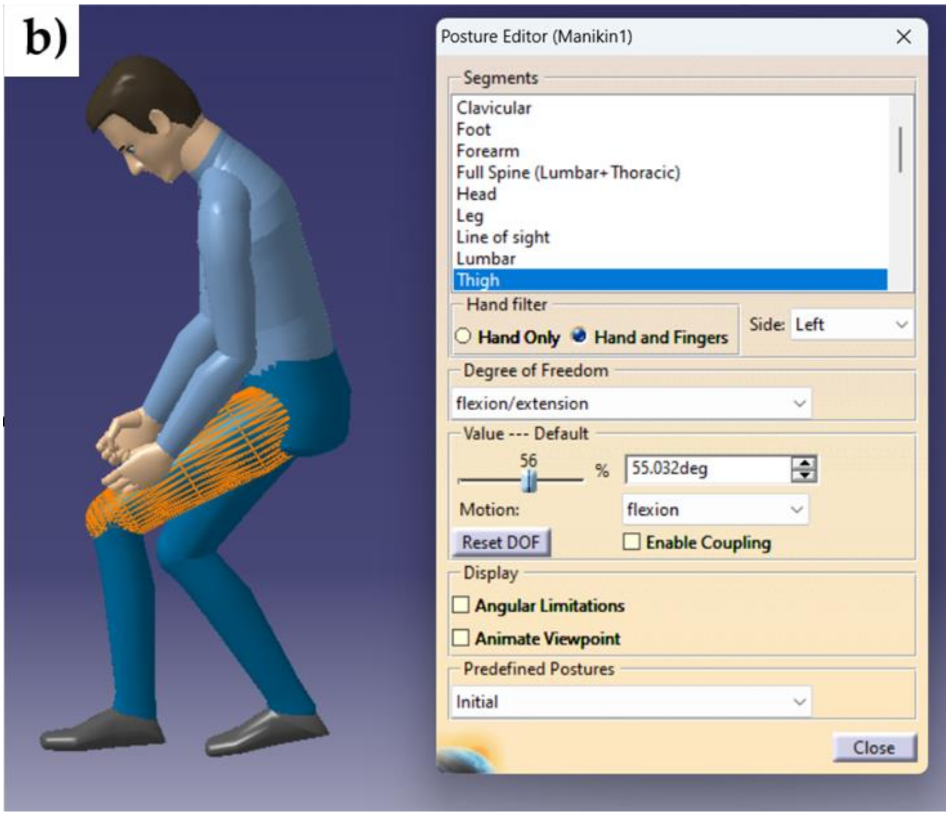


Fig. 4. 1: Ergonomics analysis of human-powered rickshaw with a conventional seat design

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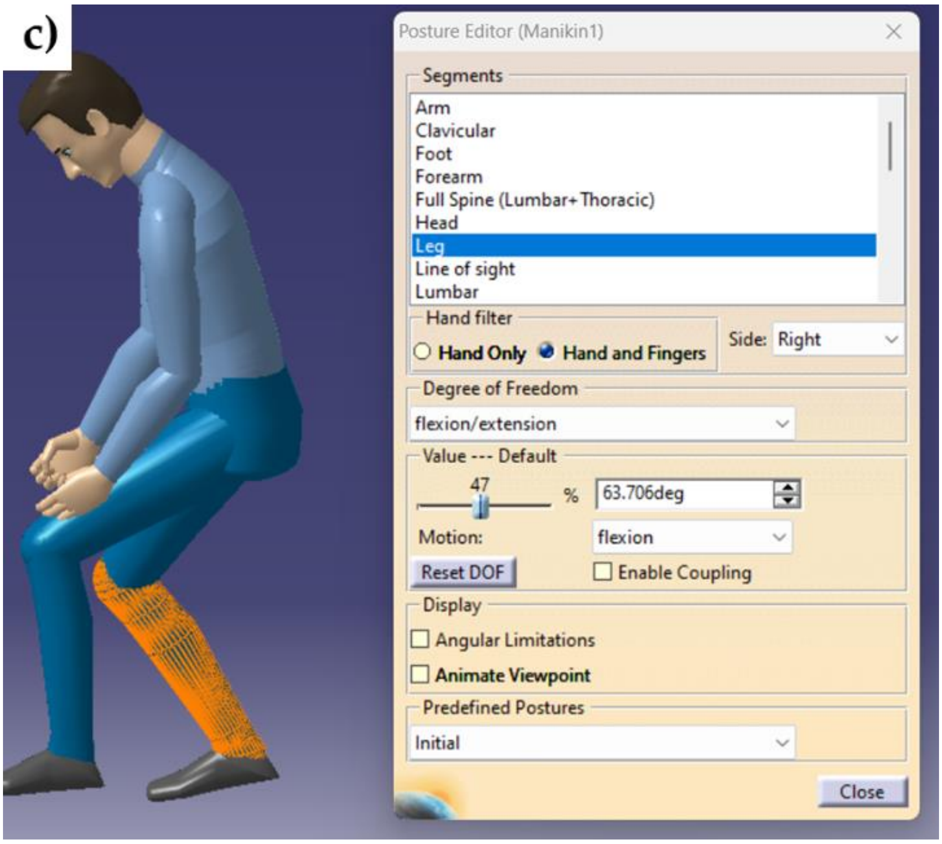
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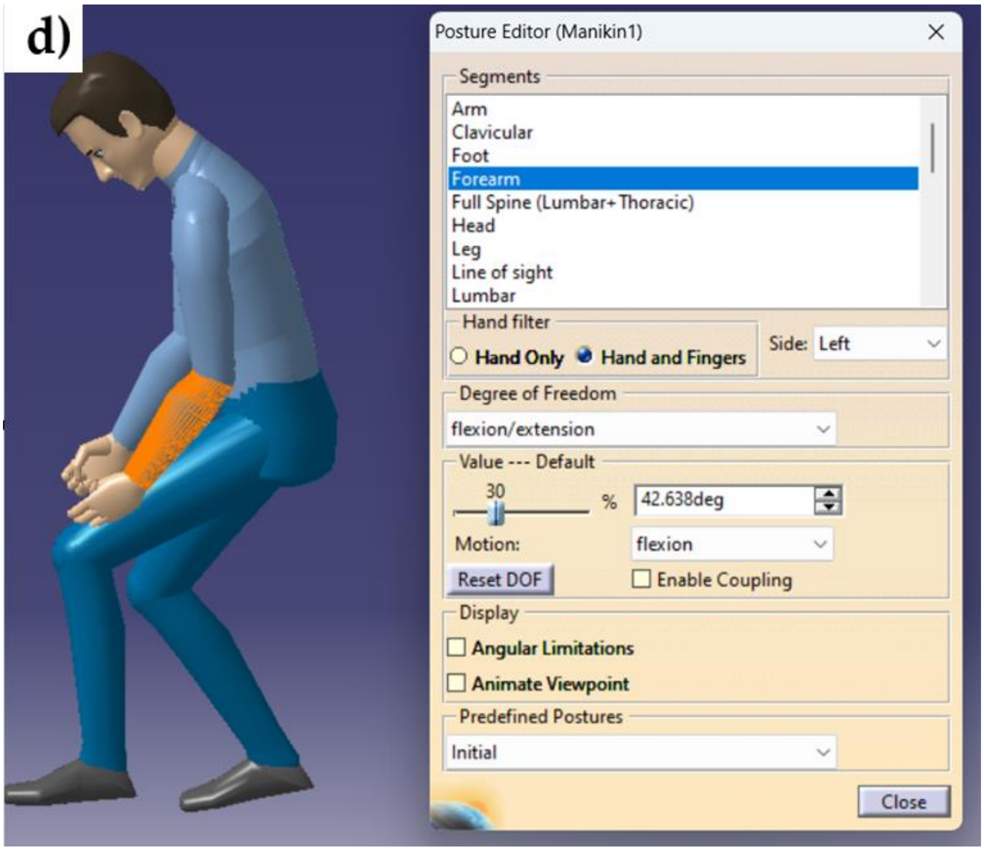
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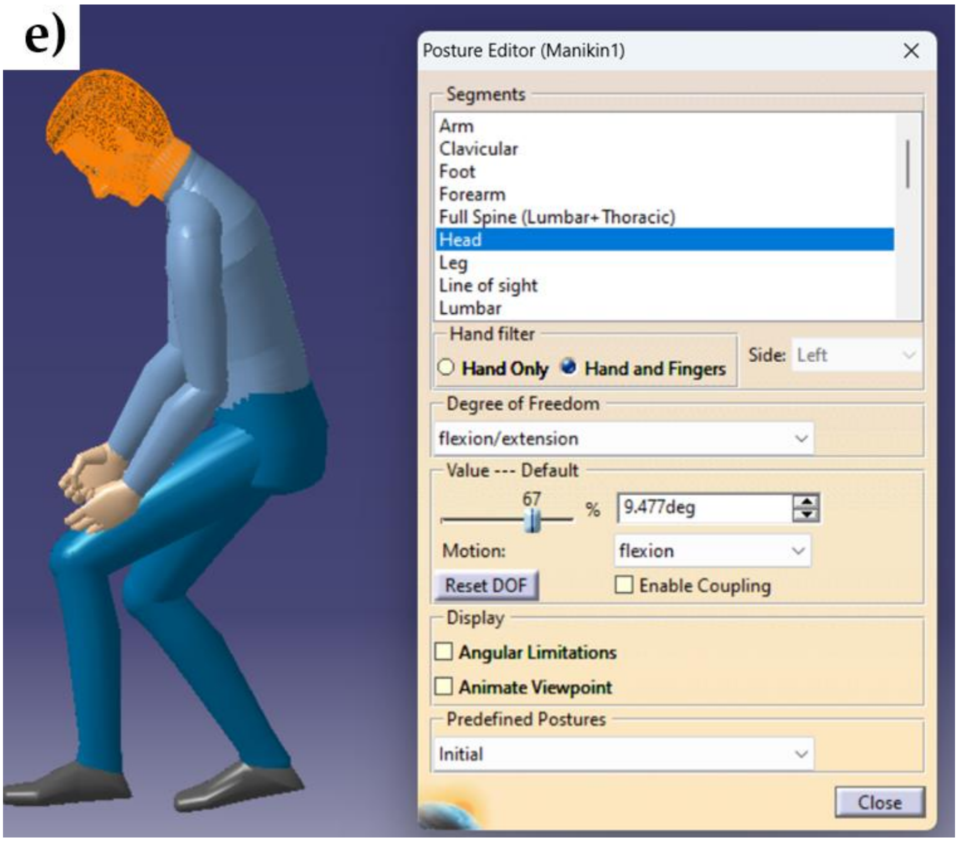
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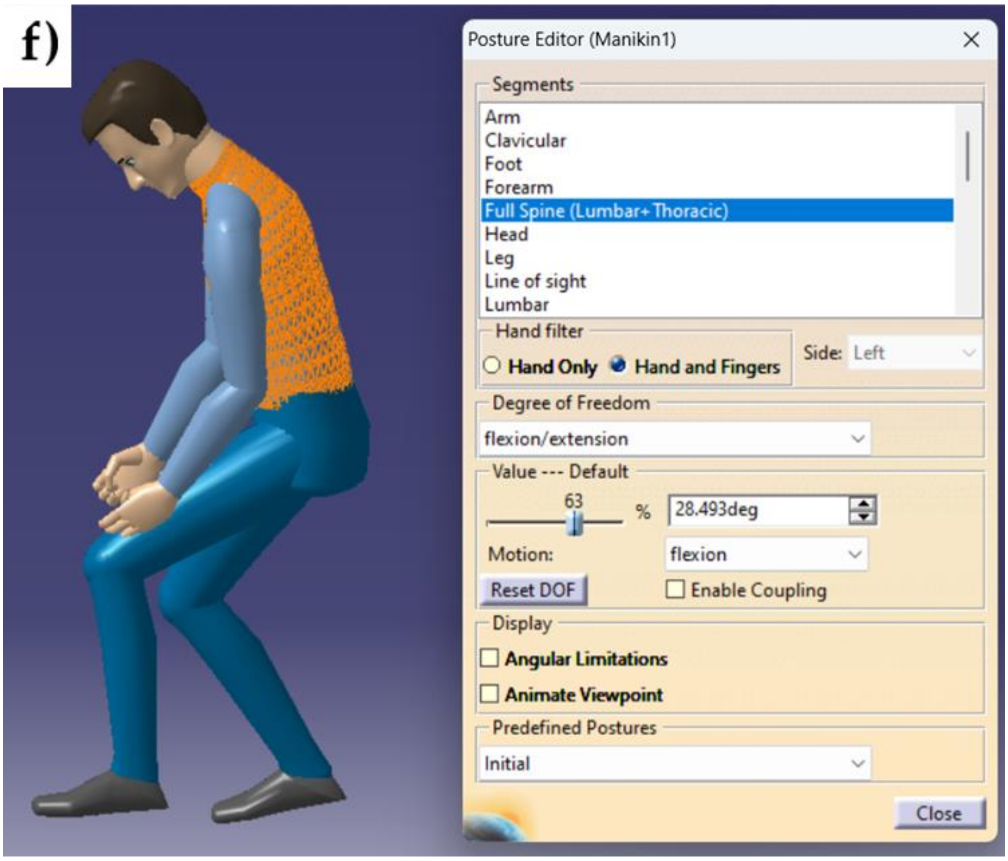


Fig. 4. 2: Posture analysis of DHM of (a) arm, (b) thigh, (c) leg, (d) forearm, (e)head, (f) full spine of a human-powered rickshaw

RULA and REBA analysis has been conducted on digital human modelling as shown in figure 4.2. The main assessment used for the ergonomic posture risk evaluations is using the RULA (Rapid Upper Limb Assessment) method and calculations. The RULA method essentially evaluates the upper limbs (hands, wrists, elbows, shoulders) but also the neck and lower back. It applies to tasks in which the operator mainly uses his upper limbs, with little or no movement. The postures are mainly studied; the repeatability is not preponderant. The RULA method, created by Dr. Lynn McAtamney and Professor E. Nigel Corlett at the University of Nottingham in England, is a postural targeting technique designed to assess the risks of work-related upper limb disorders. This method provides a quick and systematic evaluation of a worker's posture, focusing on ergonomic risk factors associated with upper extremity musculoskeletal disorders (MSD).

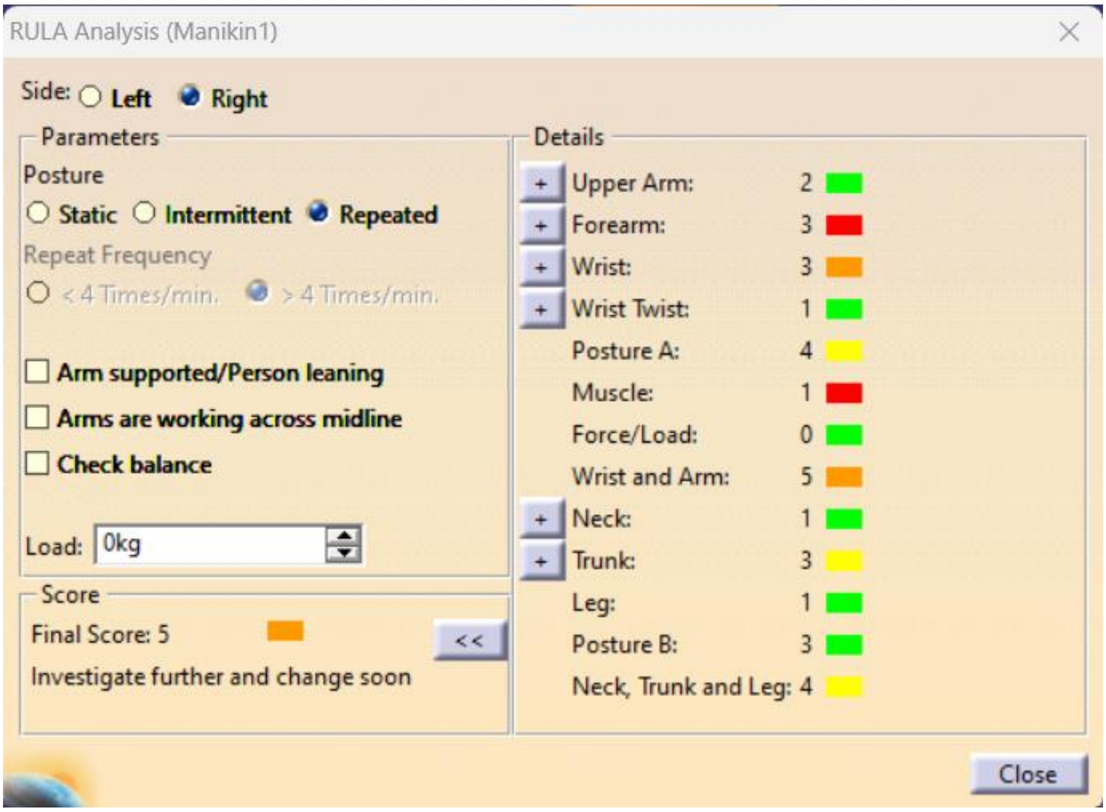


Fig. 4. 3: RULA analysis of human-powered rickshaw with a conventional seat design

It considers biomechanical and postural load requirements for tasks involving the neck, trunk, and upper extremities. The RULA tool uses a systematic process to assess body posture, force, and repetition in job tasks which can be easily seen in figure 4.3.

Table 4. 1: RULA analysis of rickshaw with conventional seat design

<table>
<tr><td colspan="6">RULA Analysis Chart</td></tr>
<tr><td>Upper Arm</td><td>2</td><td>Muscle Score</td><td>1</td><td>Leg Score</td><td>1</td></tr>
<tr><td>Lower Arm Score</td><td>3</td><td>Load Score</td><td>0</td><td>Score Table B</td><td>3</td></tr>
<tr><td>Wrist Score</td><td>2</td><td>Score Table C</td><td>5</td><td rowspan="2">Neck, Trunk, and Leg</td><td rowspan="2">4</td></tr>
<tr><td>Wrist Twist</td><td>2</td><td>Neck Score</td><td>1</td></tr>
<tr><td>Score Table A</td><td>4</td><td>Trunk Score</td><td>3</td><td>Final Score</td><td>5</td></tr>
</table>

A one-page worksheet facilitates the evaluation of body posture, muscle use, frequency, and forceful exertion. The RULA assessment tool produces a final RULA Score, ranging from 1 to 7, representing the level of MSD risk associated with the evaluated job task. Figure 1.2 outlines the RULA levels of MSD risk descriptions and corresponding cut points. The RULA analysis of this conventional design is briefly described in table 4.1. From the RULA analysis it is determined that the RULA score is 5 which implies that further investigation is needed, and change is required.

In the REBA method, the body is segmented, and each section is assigned a score based on its range of motion. Body parts with higher risk factors receive higher scores, while those with minimal risk factors receive lower scores. The REBA scores are categorized into five levels (0, 1, 2, 3, and 4) representing negligible, low, medium, high, and very high risks. Table 4.2 explains the REBA analysis of this conventional design. Immediate action is recommended for tasks categorized as medium, high, or very high to prevent potential musculoskeletal disorders. From the REBA analysis the result also indicates a score of 7 which implies further investigation as well as change immediately.

Table 4. 2: REBA analysis of rickshaw with conventional seat design

REBA Analysis Chart					
Neck Score	1	Load Score	2	Table B Score	3
Trunk Score	3	Upper Arm Score	2	Coupling Score	0
Leg Score	2	Lower Arm Score	2	Activity Score	1
Table A Score	4	Wrist Score	2	Final Score	7

4.2 Ergonomics Analysis with Modified Seat Design

To improve the ergonomics analysis and driver comfort new seat designs have been introduced as well as analyzed while keeping the anthropometric data identical as shown in figure 4.4 and figure 4.5. For analyses, no load has been applied as the boundary condition. As the modified seat design provides more comfort to the driver, the RULA analysis score reduces and shows a score of 4. The score indicates further investigation as shown in table 4.3.

Table 4. 3: RULA analysis of the rickshaw with modified seat design

RULA Analysis Chart					
Upper Arm	2	Muscle Score	1	Leg Score	1
Lower Arm Score	3	Load Score	0	Score Table B	2
Wrist Score	2	Score Table C	5	Neck, Trunk, and Leg	3
Wrist Twist	1	Neck Score	1		
Score Table A	4	Trunk Score	2	Final Score	4

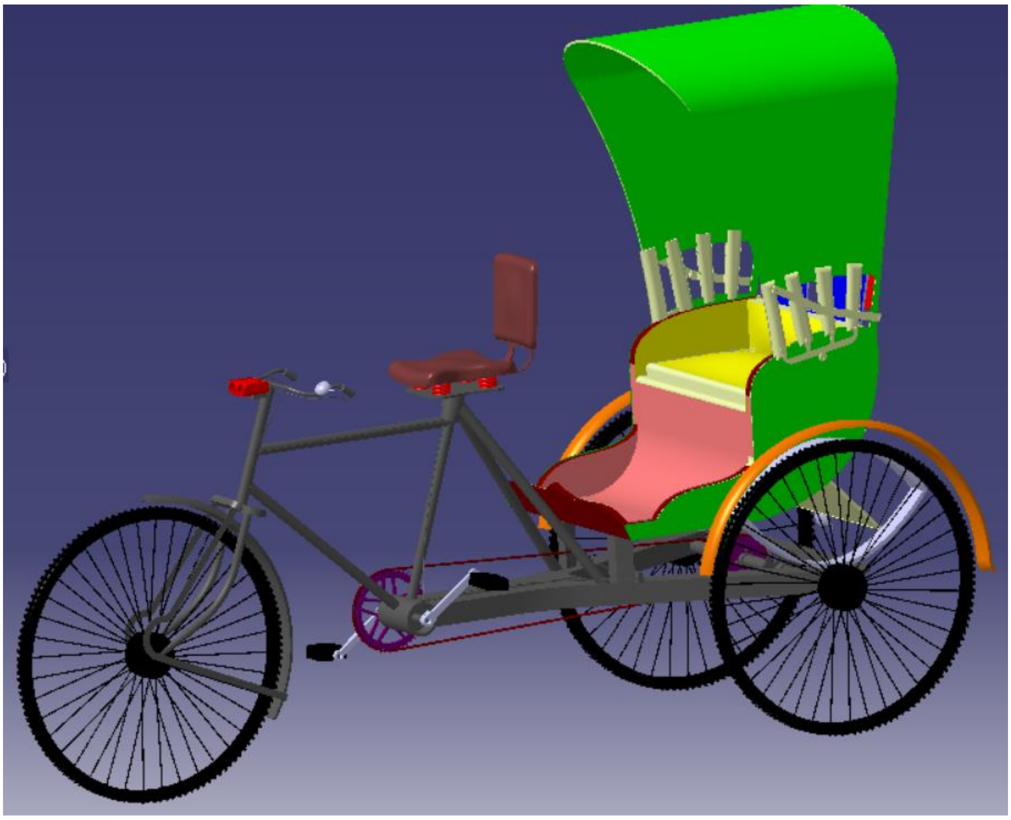


Fig. 4. 4: CAD design of a human-powered rickshaw with a modified seat design

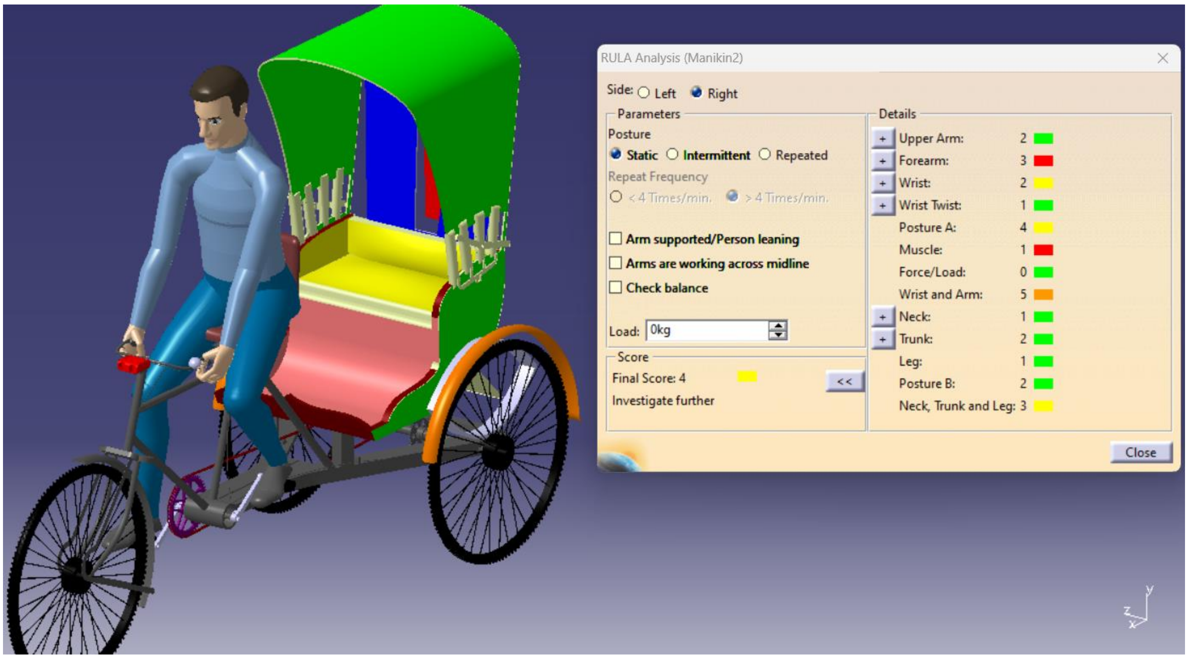


Fig. 4. 5: RULA analysis of human-powered rickshaw with a modified seat design model I

Fig. 4. 6: Human-powered rickshaw with a modified seat design model II

Table 4. 4: RULA analysis of the modified rickshaw

RULA Analysis Chart					
Upper Arm	1	Muscle Score	1	Leg Score	1
Lower Arm Score	1	Load Score	0	Score Table B	1
Wrist Score	1	Score Table C	2	Neck, Trunk, and Leg	2
Wrist Twist	1	Neck Score	1		
Score Table A	1	Trunk Score	1	Final Score	2

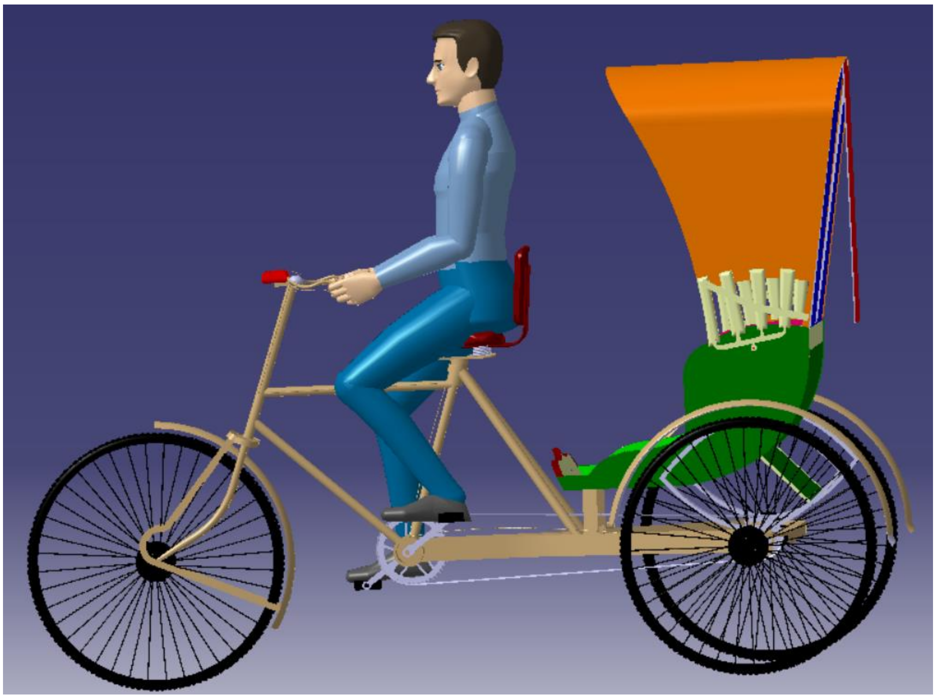


Fig. 4. 7: Ergonomic analysis of Human powered rickshaw with a modified seat design model II

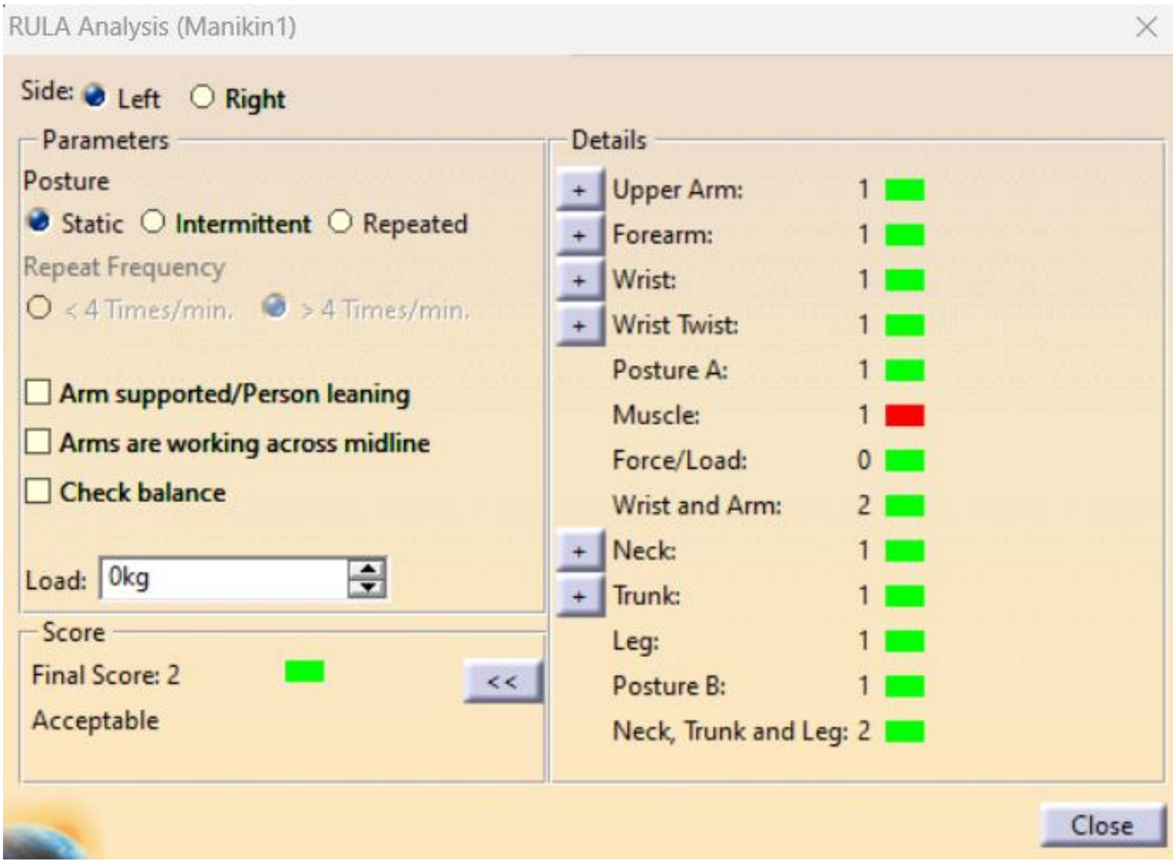


Fig. 4. 8: RULA analysis of human-powered rickshaw with a modified seat design model II

However, the forearm score still provides an option to analyze the score further to improve the final score. Hence a further approach has been taken to minimize the forearm score by increasing the handle height of the vehicle and model II has been designed as shown in figure 4.6. It allows the rickshaw puller to comfortably control the front wheel while keeping his elbow or forearm in a more comfortable position. This step improves the RULA score and brings it down to 2 which is a very acceptable score for stability in the long period.

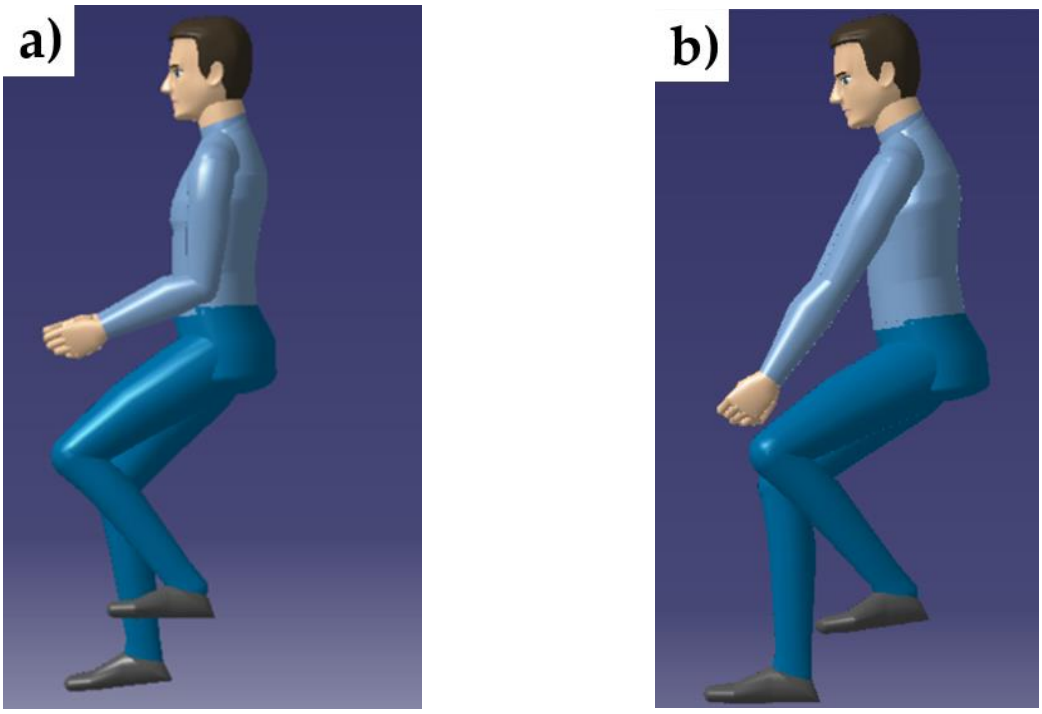


Fig. 4. 9: Forearm analysis of driver of (a) modified design (b) conventional design.

. **Table 4. 5:** REBA analysis of the rickshaw with modified seat design

REBA Analysis Chart			
Neck Score	1	Lower Arm Score	1
Trunk Score	1	Wrist Score	1
Leg Score	2	Table B Score	1
Table A Score	2	Coupling Score	0
Load Score	2	Activity Score	1
Upper Arm Score	2	Final Score	4

However, the forearm change doesn't have any remarkable effect on the REBA score. The REBA analysis result is also good compared to the previous design. The REBA score is 4 which implies medium risk.

Chapter 05

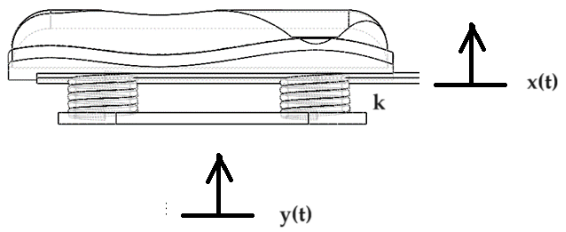
Vibration Analysis

The effect of vibration on the driver's seat in a human-powered rickshaw can be influenced by various factors, and it's important to consider both the vehicle's driver seat design and set-up. The design and quality of the suspension system play a crucial role in determining how vibrations are transmitted to the driver. A well-designed suspension system can absorb and dampen vibrations, reducing their impact on the driver. The design of the driver's seat, including the type of cushioning and its ergonomics, can affect how vibrations are transmitted to the driver. A seat with good shock absorption properties can mitigate the effects of vibrations. The posture and position of the driver can influence how vibrations are transmitted to the body. Proper ergonomic design of the seat and vehicle can help in minimizing the impact on the driver.

Individuals may have different sensitivities to vibrations. Factors such as age, health, and personal comfort preferences can affect how a driver perceives and is affected by vibrations. As the type and condition of the road surface can significantly impact the vibrations transmitted to the driver's seat, the amplified vibration of the rough and uneven surfaces should be considered too. The frequency of vibrations is a critical factor. Human sensitivity to vibrations varies with frequency, and certain frequencies may have a more pronounced impact on comfort and health. Analyzing the frequency spectrum of vibrations can provide insights into potential issues. The transmissibility of vibrations in a human-powered rickshaw is a complex interplay of vehicle design, human factors, road conditions, and maintenance. A holistic approach that considers both the mechanical aspects of the rickshaw and the human experience is essential to address and minimize the impact of vibrations on the driver's seat. This might involve a combination of design modifications, technological solutions, and ergonomic considerations. The human body's tolerance to vertical vibration can vary among individuals, and it depends on several factors such as frequency, amplitude, and duration of exposure. The tolerance to vibration also varies with age, health, and other individual characteristics.

In general, the International Organization for Standardization (ISO) provides guidelines for assessing human exposure to whole-body vibration. ISO 2631-1 is a standard that addresses the evaluation of human exposure to whole-body vibration in the frequency range of 0.5 Hz to 80 Hz. According to this standard, the tolerance of the human body to vertical vibration is typically lower in the frequency range of 4 to 8 Hz. This is known as the resonance frequency of the human body, where the body is more sensitive to vibration.

Exposure to vibrations within or near the resonance frequency can lead to discomfort, fatigue, and even health issues. However, individual sensitivity varies, and some people may be more tolerant or less affected by vibrations than others. It's important to note that there may be more specific standards or guidelines depending on the context of vibration exposure, such as occupational settings, transportation, or medical applications. If you are concerned about a specific scenario, it would be advisable to refer to relevant standards or consult with experts in the field of human vibration exposure.



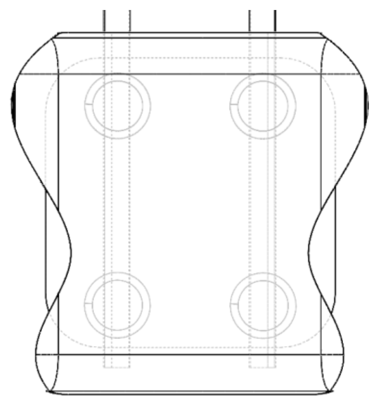


Fig. 5. 1: Schematic diagram of the vibration analysis

In this analysis y(t) is the excitation force, x(t) is the displacement of the mass and k is the stiffness of the spring. The system without un-sprung mass is SDOF system. It consists of only spring and Passenger load. A single degree of freedom (SDOF) system is a concept used in structural engineering, mechanical engineering, and dynamics to simplify the analysis of dynamic systems. In an SDOF system, there is only one independent coordinate (or degree of freedom) required to describe its motion at any given time. This means that the behavior of the entire system can be fully characterized by the motion of a single mass, point, or object.

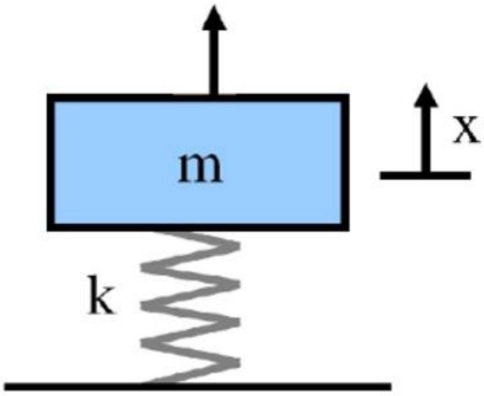


Fig. 5. 2: Single degree of freedom system

The transmissibility of a mechanical system describes how vibrations are transmitted from a source to a receiver. It is often used to evaluate the effectiveness of vibration isolation systems. Transmissibility (T) is defined as the ratio of the amplitude of the output motion (response) to the amplitude of the input motion (excitation) at a given frequency. The formula for transmissibility is given by:

$T = X_{response} / X_{excitation}$

Were,

T is the transmissibility.

$X_{response}$ is the amplitude of the response (output motion) and $X_{excitation}$ is the amplitude of the excitation (input motion). For a simple mechanical system with a single degree of freedom, the transmissibility can also be expressed in terms of the system's natural frequency (ωn), excitation frequency ($\omega_{excitation}$), damping ratio (ζ), and the ratio of excitation frequency to natural frequency ($\omega_{excitation}/\omega_n$):

$$T = 1 / (\sqrt{((1 - (\omega excitation/\omega n)^2)^2 + 4\zeta(\omega excitation/\omega n)^2})$$

$$\omega_n = \sqrt{(k/M)},$$

This formula accounts for the resonance behavior and damping in the system. When the excitation frequency ($\omega_{excitation}$) equals the natural frequency (ω_n), the transmissibility tends to infinite, indicating resonance.

Fig. 5. 3: Vibration meter

To analyze the response effect, a vibration meter (BVB-8207SD) shown in figure 5.3 is used with three channels. Both the conventional model and the modified design have been analyzed to compare the results. In both cases the input data has been recorded identically on a constant route.

Fig. 5. 4: Vibration meter sensor placed for output data

Fig. 5. 5: Vibration meter sensor placed for input data

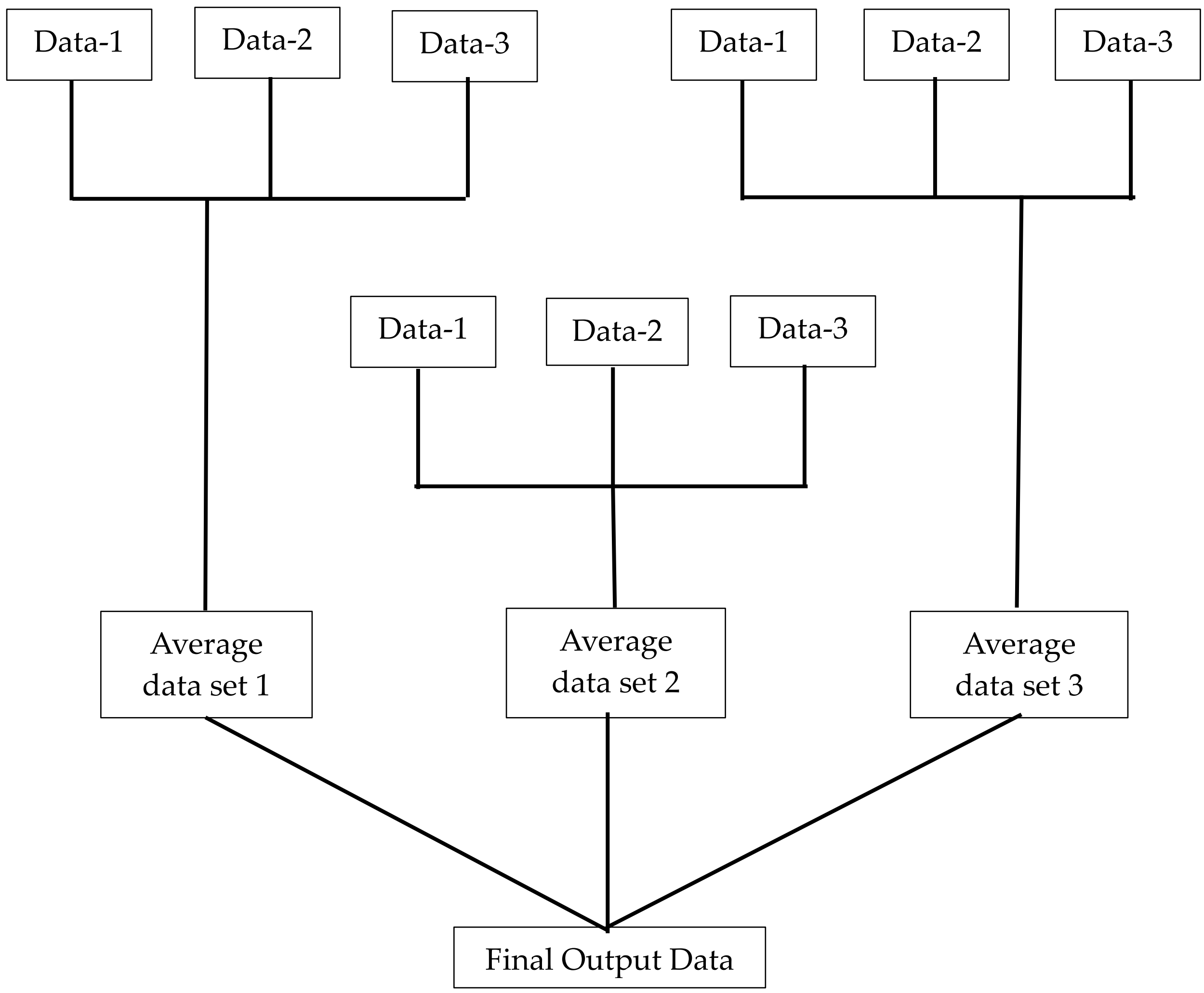


Fig. 5. 6: Block diagram of output data analyzing process

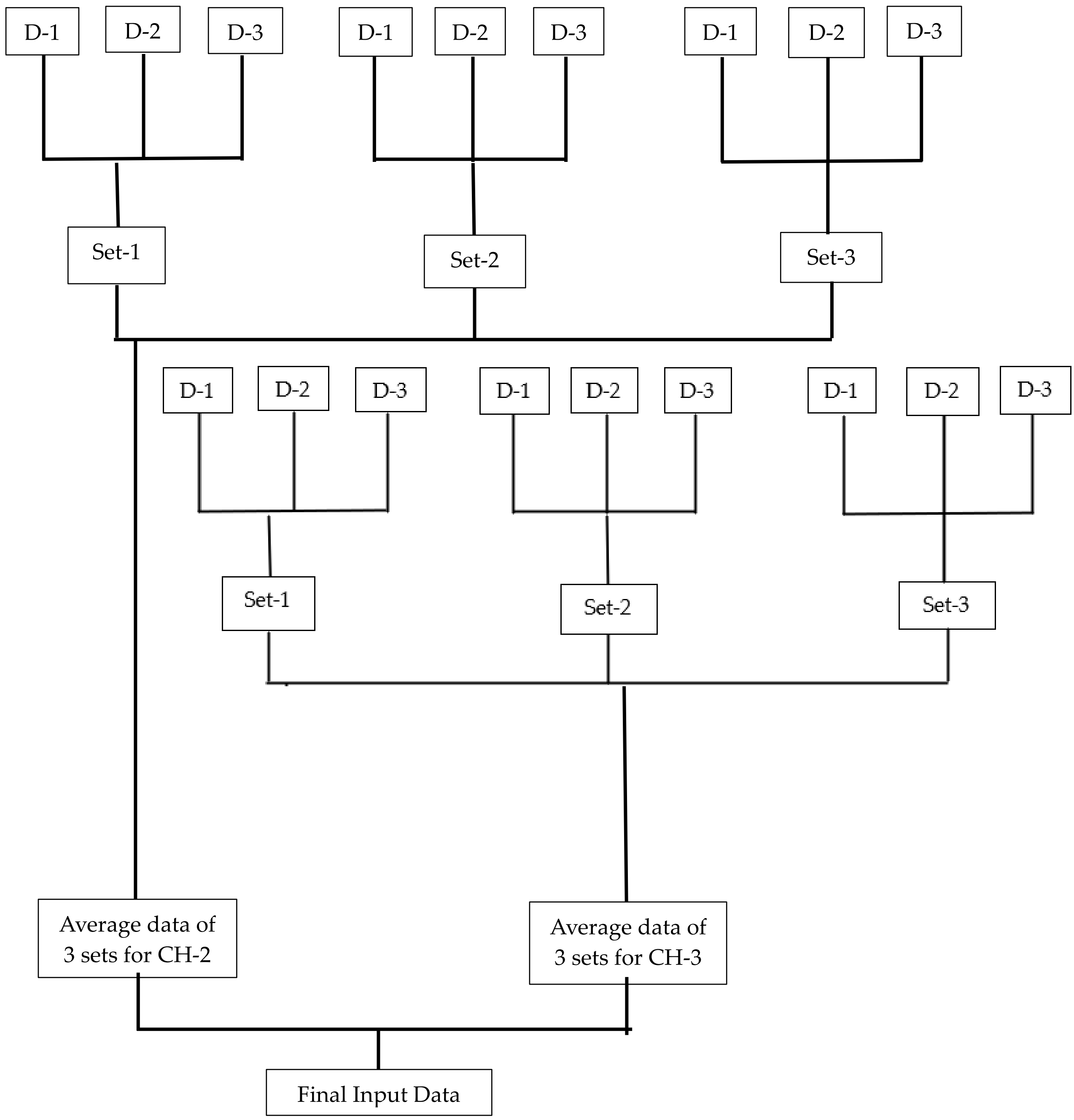


Fig. 5. 7: Block diagram of input data analyzing process.

The output data has been taken from the seats to observe the vibration which will be directly felt by the driver as shown in figure 5.4. The data has been taken three times a day for three consecutive days on a constant route for conventional and modified models separately. The data-collecting procedure can easily be understood with the help of the block diagram shown in figures 5.6 and 5.7.

The vibration meter recorded the data for acceleration, velocity, peak-to-peak displacement, and rms values. Channel one has been used as the output channel which was placed above the spring set up of the driver's seat. Channel two and channel three have been used as input channels and were placed over the rigid mudguard to ensure that the vibration applied due to the road surface could be analyzed properly as shown in figure 5.5. Block diagrams 5.6 and 5.7 represent the data-collecting process for both the input and output channels. The final input and output data have been used to calculate the response ratio for both conventional and modified models. The tables of the data record for both input and output channels are attached in the appendix.

Chapter 06

Result and Discussion

6.1 Ergonomic Analysis

The Ergonomic analysis is done through RULA and REBA analysis of the conventional and modified model. In the case of RULA analysis, the rickshaw model with the conventional seat has a score of 5 which implies that further investigation is needed, and change is required. When the suggested modified seat design is implemented the RULA score is reduced to 4 which implies further investigation. However, along with the seat design, the height of the handle of the rickshaw affects the position of the driver's forearm. Hence, modifying the design by increasing its height so that the forearm position gets more comfortable is suggested. It shows that the updated handle height can reduce the RULA score to 2 which is a very acceptable score and implies stability in the long period.

Table 6. 1: RULA analyses of the models

Rickshaw Model	RULA Score	Investigation
Rickshaw with conventional seat design	5	Further investigation is needed, and change is required
Rickshaw with modified seat design	4	Further investigation is required.
Rickshaw with modified design	2	Acceptable and ensures stability in the long period

Table 6. 2: REBA analyses of the models

Rickshaw Model	REBA Score	Investigation
Rickshaw with conventional seat design	7	Further investigation is needed, and change is required immediately
Rickshaw with modified seat design	4	Further investigation is required and provides medium risk

In the case of REBA analysis, the rickshaw with the conventional seat design has a score of 7. This high score implies further investigation as well as change immediately. The rickshaw with the modified seat design is found to have a reduced REBA score of 4 which implies medium risk.

6.2 Vibration Analysis

The vibration analysis provides experimental results with positive outcomes. The vibration meter takes the data for acceleration, velocity, acceleration g, peak-to-peak displacement, and rms value every 5 five seconds. As the route on which the rickshaws have been driven is constant, the input data does not vary very much as well as applies the same vibration response for both model designs. The data has been converted to a single input graph line to ensure clearer comparison. The calculation process is shown in the block diagrams shown in figures 5.5 and 5.6.

For the conventional model, the graph for the input and output response can be easily visualized by the graph shown below in figure 6.1. Both input and output curves show a kind of similar trendline which ensures that the data has been recorded correctly.

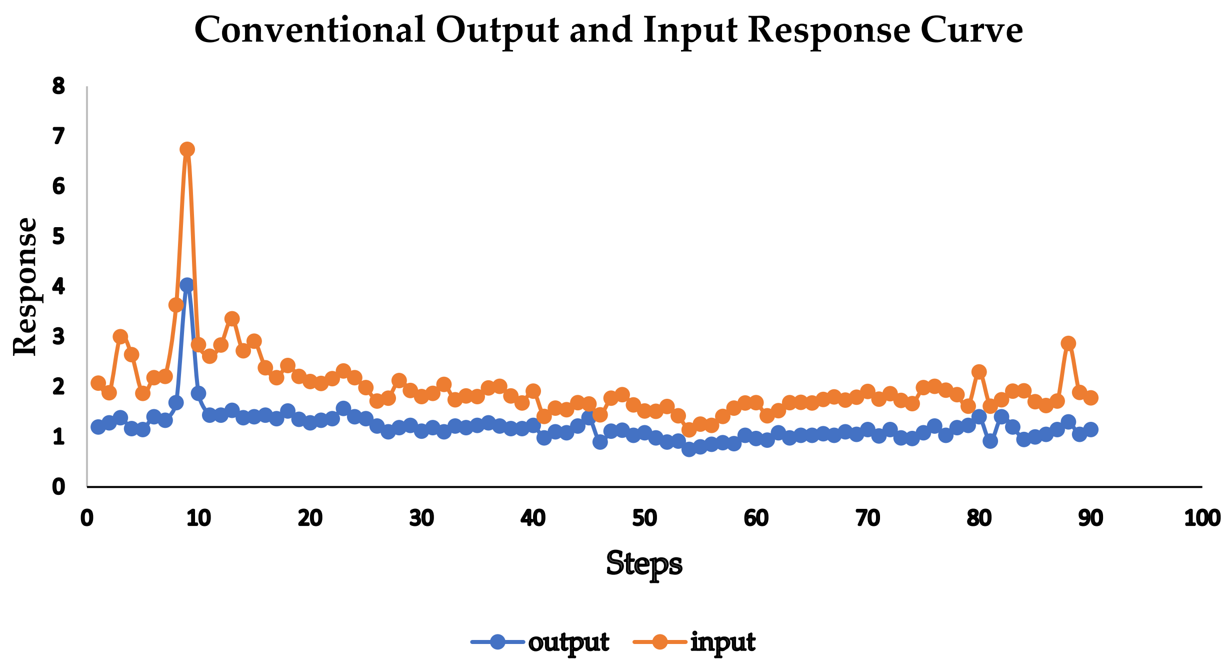


Fig. 6.1: Graphical representation of the input and output response of the conventional model

Similarly, the output and input response curve for the modified model can also be presented as shown in figure 6.2. The difference between the curve lines draws a clear image of how the vibration has been absorbed and provides a comfortable sitting position to the driver.

Finally, when the response ratios found in the vibration analyses are plotted to compare the conventional and modified model's performances, the result is established clearly as shown in figure 6.3.

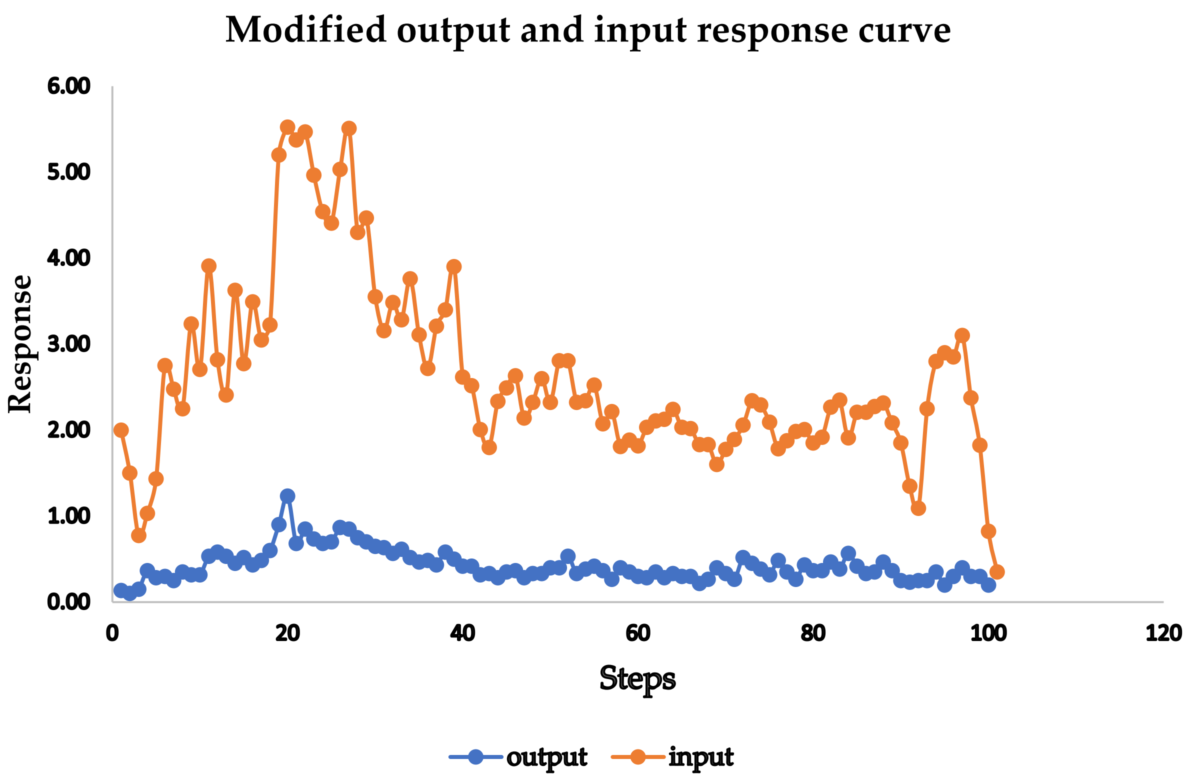


Fig. 6.2: Graphical representation of the input and output response of the modified model

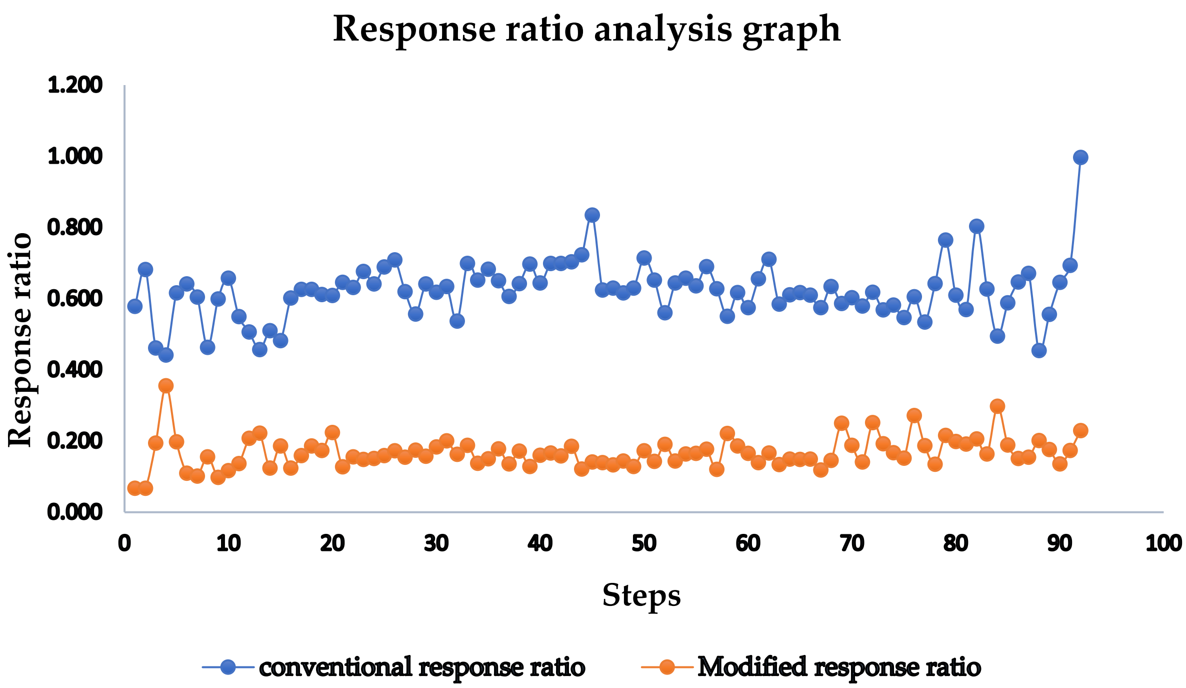


Fig. 6.3: Graphical representation of the response ratio curves of the conventional and modified model

The graph shown in figure 6.3 shows that the modified model response ratio is always lower than the conventional model response ratio. This comparison directly indicates that the modified model is more suitable from the perspective of vibration analysis to provide more comfort to the driver. Hence it can be said that both the ergonomic evaluation and the vibration analyses indicate the modified design to be better than the conventional one.

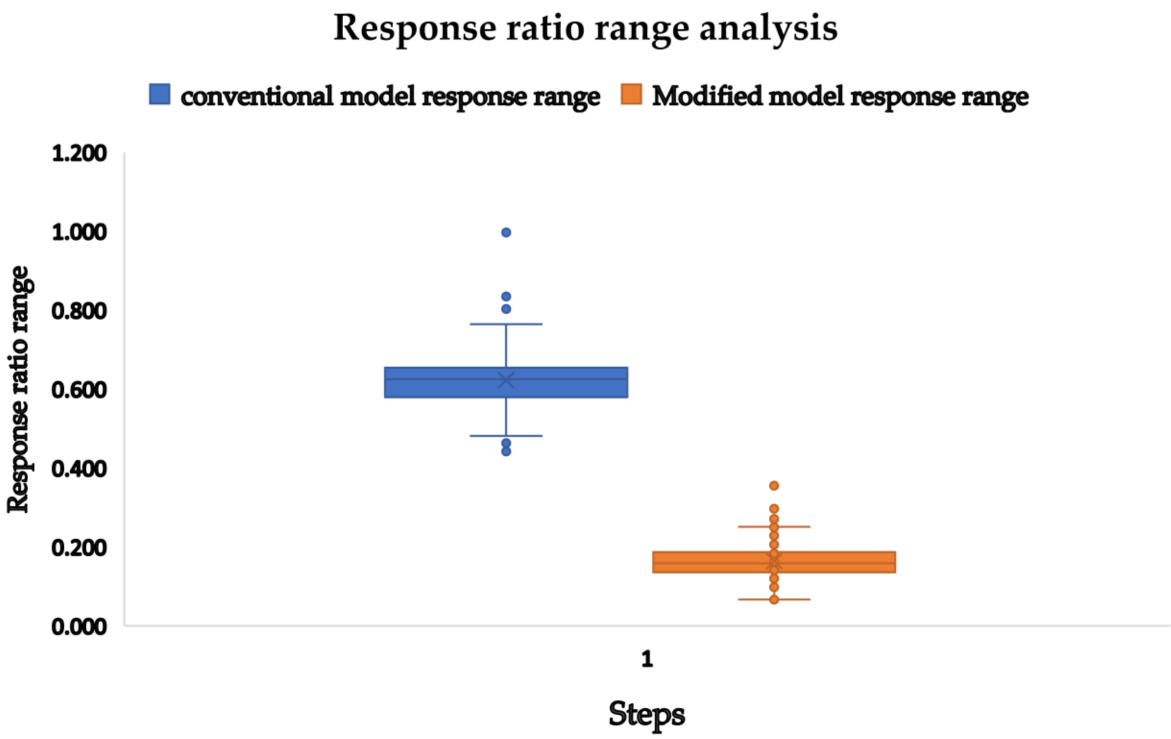


Fig. 6.4: Response ratio range analysis curves of the conventional and modified model

The range of these ratios can be easily compared and visualized with the help of a box and whisker chart as shown in figure 6.4. A box and whisker plot is an effective way to compare the distributions of two datasets, highlighting key summary statistics such as the minimum, maximum, median, and quartiles. In this chart, each box represents the interquartile range (IQR) of the dataset of response ratios for both conventional and modified models, with the median marked by a line within the box. This visualization allows for a clear comparison of the distributions of the two datasets, emphasizing the key summary statistics and highlighting the difference in range between conventional and modified response ratios. The first bar (conventional response ratio) represents the range from 0.442 to 0.996, with the minimum value located at 0.442. The second bar (modified response ratio) represents the range from 0.067 to 0.335, with the maximum value located at 0.335. The mean value of conventional model data (0.622) and modified model data (0.163) is labeled within the respective boxes, allowing for a direct comparison. The length of the box and the position of the median line also give a visual indication of where the bulk of the data lies in each dataset. The lower end of the box plot for conventional model data indicates the minimum value (0.442) whereas the upper end of the box plot for modified model data indicates the maximum value (0.335). The labels clarify that these values represent the extremities of each dataset. This emphasizes that the maximum value of the response ratio as shown in the modified model is indeed lower than the minimum value of the response ratio as shown in the conventional model, highlighting the difference in their ranges, and providing a clear visual comparison within the context of the plot. Hence, it reassures the fact that the suggested modified model is much more comforting and effective for the purpose.

Chapter 07

Conclusion and Future Work

7.1 Conclusion

In a busy country, rickshaws play a crucial role in providing affordable and accessible transportation options, especially in densely populated urban areas where congestion is common. Rickshaws offer a convenient mode of travel for short distances, serving as a last-mile connectivity solution and filling gaps in public transportation networks. They are nimble enough to navigate through narrow streets and congested traffic, making them invaluable for reaching destinations quickly and efficiently. Additionally, rickshaws contribute to the livelihoods of many drivers and operators, particularly in regions where they serve as a primary source of income. Overall, rickshaws serve as a vital component of transportation infrastructure, enhancing mobility and accessibility in busy urban environments. Hence it is important to prioritize the comfort of the rickshaw driver. The comfort of a rickshaw driver is essential for several reasons. Firstly, it directly impacts their health and well-being, as prolonged periods of discomfort can lead to musculoskeletal issues and fatigue. Secondly, a comfortable working environment enhances the driver's productivity and concentration, which is crucial for safe navigation through busy streets and traffic. Additionally, driver comfort influences customer satisfaction, as a relaxed and attentive driver is more likely to provide a pleasant ride experience. Overall, prioritizing the comfort of rickshaw drivers is essential for promoting their health, safety, job satisfaction, and overall well-being. The comfort of a rickshaw driver is heavily dependent on their seat arrangement because it directly impacts their posture, support, and overall well-being during long hours of driving. A well-designed seat with proper cushioning, ergonomics, and adjustability can help reduce fatigue, minimize strain on the body, and enhance the driver's overall comfort, leading to improved performance, safety, and job satisfaction. Hence this study focuses on the modification of rickshaw driver’s seat to provide more comfort while ensuring ergonomics.

This study emphasizes the significant role of springs in the driver's seat of a human-powered rickshaw, highlighting their importance in providing both comfort and functionality. Springs absorb shocks and vibrations from diverse terrains, reducing fatigue and minimizing the risk of musculoskeletal issues for the driver. Additionally, a comfortable seating arrangement with an ergonomic shape enhances vehicle control, ensuring a smoother and safer ride. However, conventional spring setups and seat designs have limitations, such as limited shock absorption, lack of customization options, and susceptibility to wear and tear. Despite these drawbacks, the addition of springs contributes to overall weight distribution and vibration absorption, enhancing comfort during long hours of driving. Therefore, the incorporation of springs remains crucial for optimizing the design and functionality of rickshaws, prioritizing the well-being of drivers, and improving the overall driving experience. In this study, measurements of various cycle rickshaw frames were taken, and a basic design for the model structure with a conventional seat was finalized using CATIA V5. Some parts of the structure were designed separately based on the frame to complete the overall design. Afterward, a modified driver seat design was suggested, designed, and fabricated. Ergonomic analyses were done on these models. Afterward, for experimental purposes, a wood-based seat base, followed by a cushion setup, was fabricated and implemented on a rickshaw to provide practical experimental data. Overall, the study aims to optimize the design of cycle rickshaw seats to improve comfort and performance for drivers engaging in prolonged periods of operation.

The study conducted ergonomic analysis on the conventional and modified design of rickshaw seats using CATIA V5. Anthropometric data and digital human modeling (DHM) were employed, allowing for virtual testing of the seat's ergonomics. RULA and REBA analyses were performed on digital human models to evaluate posture and identify potential musculoskeletal risks. Both analyses indicated a score of 5 for RULA and 7 for REBA, suggesting the need for further investigation and immediate changes to mitigate ergonomic risks associated with the rickshaw seat design. To enhance ergonomics and driver comfort, the modified seat designs were introduced and analyzed using identical anthropometric data. No load was applied as a boundary condition for the analysis. The modified seat design improved driver comfort, reducing the RULA analysis score to 4, and indicating the need for further investigation. To address the forearm score, the handle height of the vehicle was increased, allowing the driver to control the front wheel more comfortably. This adjustment lowered the RULA score to 2, signifying stability over extended periods. However, the forearm change had no significant effect on the REBA score, which remained at 4, indicating a medium risk level. Overall, the modified seat design and handle height adjustment positively impacted driver comfort and ergonomics.

Once the ergonomics analyses ensured a positive result, the fabricated models were experimented with for vibration analysis. In this analysis, the system is described by an equation with y(t) representing the excitation force, x(t) denoting the displacement of the mass, and k representing the stiffness of the spring. The system under consideration is a Single Degree of Freedom (SDOF) system, consisting solely of a spring and passenger load, without an un-sprung mass. SDOF systems simplify the analysis of dynamic systems by requiring only one independent coordinate to describe motion at any given time. To assess the response effect, a vibration meter (BVB-8207SD) with three channels was employed. Both the conventional and modified designs were analyzed, and their results were compared. Data was recorded identically for both models along a consistent route. Vibration data, directly felt by the driver, was collected from the seats. Data collection occurred three times a day for three consecutive days for each model. The vibration meter recorded acceleration, velocity, peak-to-peak displacement, and root mean square (rms) values. Channel one served as the output channel, positioned above the driver's seat's spring setup. Channels two and three acted as input channels, placed over the rigid mudguard to analyze vibrations originating from the road surface. The response curves shown in this study represented the fact that the output-to-input ratio of the modified design was much lower than the conventional design. Hence, the analyses could establish the fact that the modified design could absorb more vibration ensuring more comfort to the driver.

7.2 Future Recommendations

While the study has made significant strides in improving the comfort and ergonomics of rickshaw driver's seats through modifications and vibration analysis, there are several areas where it could be further enhanced, and future recommendations can be made:

- While the study conducted RULA and REBA analyses to assess posture and musculoskeletal risks, there may be other ergonomic factors that were not fully addressed. Future studies could incorporate additional ergonomic assessments or consider different ergonomic evaluation tools to provide a more comprehensive analysis of driver comfort.
- Incorporating feedback from rickshaw drivers themselves could provide valuable insights into their comfort preferences and practical challenges faced during operation. Future studies could involve driver surveys or interviews to gather qualitative data on comfort perceptions and potential areas for improvement.

- While the study focused on a modified seat design with springs, future research could explore the feasibility of customizable seat options to cater to individual driver preferences and ergonomic needs. This could involve adjustable features such as seat height, angle, lumbar support, and armrests.

- While optimizing comfort is important, it's also essential to consider the cost-effectiveness of seat modifications, particularly in regions where rickshaw drivers may have limited financial resources. Future studies could explore cost-effective solutions that balance comfort improvements with affordability.

- Collaboration with government authorities, rickshaw manufacturers, and driver associations could help facilitate the implementation of seat modifications on a larger scale. Engaging stakeholders from the outset can ensure the sustainability and scalability of the proposed improvements.

In conclusion, while the study has made significant progress in enhancing the comfort and ergonomics of rickshaw seats, there are opportunities for further research and improvements to address the identified limitations and ensure the long-term success of the proposed modifications.

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Appendices

Table: Set 1 data for channel one (output) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
1	0.2	1.6	0.9	15.2	12	13.6	0.724	0.26	0.492
2	0.8	0.6	0.7	11.7	7.6	9.65	0.495	0.199	0.347
3	0.3	0.9	0.6	12.4	11.6	12	0.527	0.441	0.484
4	0.1	1.1	0.6	17.2	23.9	20.55	0.352	0.366	0.359
5	0.1	1	0.55	11.3	9.4	10.35	0.387	0.341	0.364
6	0.1	1	0.55	14	8.1	11.05	0.436	0.185	0.3105
8	0.1	1.1	0.6	27.8	9	18.4	0.403	0.365	0.384
9	0.1	1.2	0.65	21.3	9.7	15.5	0.698	0.487	0.5925
10	14.8	1.6	8.2	7.5	10.8	9.15	0.513	0.344	0.4285
11	1.5	1	1.25	9	30.5	19.75	0.501	0.205	0.353
12	0.8	1.6	1.2	11.7	12.1	11.9	0.449	0.311	0.38
13	0.3	1.7	1	15.6	7.8	11.7	0.279	0.44	0.3595
14	0.2	1.6	0.9	11.8	13.8	12.8	0.627	0.519	0.573
15	0.1	1.5	0.8	13.6	7.8	10.7	0.405	0.652	0.5285
16	0.2	1.1	0.65	7.5	16	11.75	0.449	0.445	0.447
17	0.1	1.6	0.85	7.4	5.1	6.25	0.65	0.403	0.5265
18	0.1	2.2	1.15	9.5	9	9.25	0.484	0.394	0.439
19	0.1	2.3	1.2	9.3	8.7	9	0.496	0.52	0.508
21	1.1	1.5	1.3	11.5	8.4	9.95	0.464	0.355	0.4095
22	1.3	1.6	1.45	10.1	13.8	11.95	0.698	0.381	0.5395
23	1	1.5	1.25	10.7	9.5	10.1	1.219	0.412	0.8155
24	1.8	1.7	1.75	11.6	13.4	12.5	0.688	0.452	0.57
25	2.3	1.4	1.85	5.5	8.9	7.2	0.684	0.44	0.562
26	2.3	1.2	1.75	11.1	11.2	11.15	0.813	0.524	0.6685
27	2.3	1.2	1.75	11.8	10	10.9	0.972	0.503	0.7375
28	2.4	1	1.7	9.1	14.9	12	0.744	0.439	0.5915
29	1.6	0.7	1.15	7.4	9.6	8.5	0.525	0.376	0.4505
30	2	1.1	1.55	14.8	6.5	10.65	0.573	0.394	0.4835
31	2	1.1	1.55	10.9	11.8	11.35	0.837	0.394	0.6155
32	1.6	0.9	1.25	9.5	10.6	10.05	0.58	0.43	0.505
33	1.6	1.2	1.4	12	13.7	12.85	0.817	0.889	0.853
34	1.7	1	1.35	10.4	12.1	11.25	0.8	0.388	0.594

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
35	1.6	0.9	1.25	6.9	8.2	7.55	0.427	0.37	0.3985
36	1.2	1.3	1.25	11.1	9.3	10.2	0.552	0.305	0.4285
37	1.1	1.2	1.15	9.3	9.7	9.5	0.53	0.33	0.43
38	1.4	1	1.2	14.4	9.3	11.85	0.378	0.524	0.451
39	1.1	1	1.05	8.1	6.1	7.1	0.506	0.567	0.5365
40	1	1.2	1.1	18.8	7.1	12.95	0.464	0.758	0.611
41	1	1.9	1.45	19.3	9.6	14.45	0.359	0.222	0.2905
42	1.2	1.6	1.4	8.9	6.6	7.75	0.396	0.629	0.5125
43	1	1.3	1.15	16.7	12.2	14.45	0.609	0.507	0.558
44	1.6	1.2	1.4	7.2	6.9	7.05	0.539	0.424	0.4815
45	1	1.8	1.4	9.3	11.6	10.45	0.465	0.356	0.4105
46	2.1	1.5	1.8	11.6	13.2	12.4	0.546	0.496	0.521
47	3.2	1.8	2.5	6.2	14.7	10.45	0.759	0.643	0.701
48	1	1.3	1.15	10	14	12	0.416	0.508	0.462
49	1.8	1.1	1.45	9.6	8.9	9.25	0.69	0.463	0.5765
50	1.9	1.6	1.75	6.8	12.9	9.85	0.633	0.437	0.535
51	1.6	0.8	1.2	7.8	10.6	9.2	0.711	0.614	0.6625
52	0.9	1	0.95	8.6	8.4	8.5	0.607	0.607	0.607
53	1	0.9	0.95	9.9	5.8	7.85	0.426	0.426	0.426
54	0.9	0.7	0.8	9.2	9.2	9.2	0.803	0.803	0.803
55	0.9	0.8	0.85	9.9	6.1	8	0.447	0.447	0.447
56	0.8	0.6	0.7	10	10.3	10.15	0.703	0.703	0.703
57	0.9	0.7	0.8	6.1	7.6	6.85	0.426	0.426	0.426
58	0.9	0.9	0.9	11.4	6.5	8.95	0.39	0.39	0.39
59	0.9	0.7	0.8	6.3	9	7.65	0.557	0.557	0.557
60	0.7	0.8	0.75	6.3	6.5	6.4	0.454	0.454	0.454
61	0.8	1	0.9	12	7.4	9.7	0.382	0.382	0.382

Table: Set 1 data for channel two (input I) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
1	0.2	1	0.6	46.8	1.7	24.25	1.319	0.03	0.6745
2	0.4	0.5	0.45	24.2	2	13.1	1.271	0.024	0.6475
3	0.2	0.8	0.5	16.6	2.9	9.75	1.197	0.025	0.611

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
4	0.1	1.6	0.85	23.8	2.9	13.35	0.806	0.029	0.4175
5	0.1	0.6	0.35	25	2.3	13.65	0.92	0.026	0.473
6	0	1.2	0.6	15.3	1.9	8.6	0.613	0.013	0.313
8	0.1	0.7	0.4	25.9	3.5	14.7	1.136	0.032	0.584
9	0	0.6	0.3	70.2	2.9	36.55	0.787	0.036	0.4115
10	29	0.7	14.85	28.5	2.6	15.55	1.069	0.021	0.545
11	0.8	0.6	0.7	17.2	1.7	9.45	0.84	0.016	0.428
12	0.3	1.1	0.7	23	2.3	12.65	1.513	0.022	0.7675
13	0.1	1.5	0.8	18	2.4	10.2	0.759	0.03	0.3945
14	0.1	0.9	0.5	21.4	1.7	11.55	1.125	0.037	0.581
15	0.1	1	0.55	20.3	1.9	11.1	0.791	0.029	0.41
16	0.2	0.7	0.45	14.7	3.1	8.9	1.026	0.029	0.5275
17	0.1	1.3	0.7	16.3	1.5	8.9	1.195	0.04	0.6175
18	0.1	1.3	0.7	15.9	2.7	9.3	0.976	0.035	0.5055
19	0	1.3	0.65	15.8	2.3	9.05	1.096	0.037	0.5665
21	2.3	1.3	1.8	15.3	2.2	8.75	1.1	0.036	0.568
22	1.9	1.2	1.55	20.9	2.1	11.5	1.375	0.031	0.703
23	1.8	1.4	1.6	33.3	2.9	18.1	1.378	0.038	0.708
24	3.1	1.2	2.15	16.2	2.5	9.35	1.144	0.038	0.591
25	5.7	1	3.35	12.1	2.5	7.3	1.741	0.035	0.888
26	4.9	1	2.95	13.1	3.1	8.1	1.471	0.061	0.766
27	6.5	1.1	3.8	26.2	2.4	14.3	0.9	0.037	0.4685
28	4.5	0.6	2.55	16.1	2.5	9.3	1.641	0.035	0.838
29	4.7	0.5	2.6	14.9	2	8.45	1.482	0.059	0.7705
30	7.6	0.7	4.15	16.8	2.3	9.55	1.276	0.042	0.659
31	4.7	0.7	2.7	19.1	2.3	10.7	1.531	0.048	0.7895
32	4.4	0.7	2.55	18	2.1	10.05	1.406	0.041	0.7235
33	3.5	0.7	2.1	18	1.9	9.95	1.553	0.083	0.818
34	6.8	0.7	3.75	16.5	1.9	9.2	1.803	0.032	0.9175
35	4.4	0.7	2.55	17.3	2	9.65	1.699	0.038	0.8685
36	2.8	0.7	1.75	21.3	2	11.65	1.249	0.04	0.6445
37	2.2	0.7	1.45	19	1.5	10.25	1.482	0.034	0.758
38	2.7	0.8	1.75	16.6	1.5	9.05	0.9	0.038	0.469
39	3.2	0.9	2.05	21.5	1.7	11.6	1.093	0.042	0.5675
40	2.3	0.9	1.6	30.8	1.7	16.25	0.856	0.037	0.4465
41	2.3	0.9	1.6	32.3	2.8	17.55	0.764	0.031	0.3975
42	2.4	0.9	1.65	10	2.1	6.05	0.903	0.055	0.479
43	2	0.9	1.45	13.9	2.7	8.3	1.324	0.045	0.6845

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
44	3.2	0.8	2	18.3	3.2	10.75	0.902	0.039	0.4705
45	2.7	0.8	1.75	19.2	2.4	10.8	1.073	0.036	0.5545
46	3.9	1	2.45	14.5	3	8.75	1.328	0.045	0.6865
47	2.8	1	1.9	12.9	3.1	8	0.825	0.102	0.4635
48	2	1	1.5	15.5	2.7	9.1	0.92	0.063	0.4915
49	4.4	0.7	2.55	17.1	2.4	9.75	1.002	0.066	0.534
50	5.1	0.9	3	12.3	3	7.65	1.799	0.046	0.9225
51	3.1	0.7	1.9	11.3	2	6.65	1.236	0.046	0.641
52	2.1	0.8	1.45	12.5	2.1	7.3	0.067	0.067	0.067
53	2.3	0.7	1.5	15	1.1	8.05	0.048	0.048	0.048
54	2.1	0.6	1.35	24.5	1.5	13	0.057	0.057	0.057
55	2.1	0.7	1.4	21.7	1	11.35	0.045	0.045	0.045
56	2	0.5	1.25	24.2	1.3	12.75	0.074	0.074	0.074
57	2.2	0.6	1.4	16.3	1.5	8.9	0.035	0.035	0.035
58	1.8	0.8	1.3	9.5	1.5	5.5	0.077	0.077	0.077
59	2.2	0.6	1.4	14.4	1.3	7.85	0.042	0.042	0.042
60	1.7	0.7	1.2	17.7	1.3	9.5	0.041	0.041	0.041
61	2	0.8	1.4	15.6	1.3	8.45	0.04	0.04	0.04
62	2.1	0.7	1.4	1.6	1.6	1.6	0.033	0.033	0.033
63	2.2	0.8	1.5	1.1	1.1	1.1	0.032	0.032	0.032
64	2.3	0.7	1.5	1.5	1.5	1.5	0.033	0.033	0.033
65	1.9	0.7	1.3	1.3	1.3	1.3	0.025	0.025	0.025
66	2.1	0.7	1.4	1.5	1.5	1.5	0.029	0.029	0.029
67	1.8	0.9	1.35	1.1	1.1	1.1	0.032	0.032	0.032
68	2	0.7	1.35	1.7	1.7	1.7	0.025	0.025	0.025
69	2.4	0.7	1.55	1.6	1.6	1.6	0.024	0.024	0.024
70	2.8	0.8	1.8	1.5	1.5	1.5	0.024	0.024	0.024
71	2	1.3	1.65	1.9	1.9	1.9	0.041	0.041	0.041
72	3.2	0.7	1.95	4.4	4.4	4.4	0.038	0.038	0.038
73	2.3	0.7	1.5	2.2	2.2	2.2	0.033	0.033	0.033
74	2.1	0.9	1.5	1.7	1.7	1.7	0.035	0.035	0.035
75	2.3	0.7	1.5	1.8	1.8	1.8	0.029	0.029	0.029
76	2.4	0.7	1.55	1.6	1.6	1.6	0.024	0.024	0.024
77	2.2	0.8	1.5	1.8	1.8	1.8	0.028	0.028	0.028
78	2.4	0.7	1.55	1.6	1.6	1.6	0.031	0.031	0.031
79	2.3	0.7	1.5	1.7	1.7	1.7	0.03	0.03	0.03
80	3.2	1	2.1	1.4	1.4	1.4	0.024	0.024	0.024
81	2.5	0.8	1.65	1.8	1.8	1.8	0.041	0.041	0.041

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
82	5.1	0.9	3	2.6	2.6	2.6	0.053	0.053	0.053
83	2.3	0.9	1.6	2.4	2.4	2.4	0.028	0.028	0.028
84	2.8	0.6	1.7	1.5	1.5	1.5	0.054	0.054	0.054
85	2.9	0.7	1.8	2.1	2.1	2.1	0.049	0.049	0.049
86	2.8	0.7	1.75	1.5	1.5	1.5	0.074	0.074	0.074
87	3.4	0.6	2	1.6	1.6	1.6	0.038	0.038	0.038
88	2.7	0.7	1.7	1.8	1.8	1.8	0.054	0.054	0.054
89	2.9	0.7	1.8	1.5	1.5	1.5	0.065	0.065	0.065
90	2.8	0.8	1.8	5.6	5.6	5.6	0.042	0.042	0.042
91	2.7	0.8	1.75	2	2	2	0.043	0.043	0.043
92	2.7	0.8	1.75	3	3	3	0.034	0.034	0.034

Table: Set 1 data for channel three (input II) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
1	0.2	4.4	2.3	2.1	25.6	13.85	0.055	0.744	0.3995
2	0.1	1.9	1	1.6	21.6	11.6	0.054	0.563	0.3085
3	0.1	2.6	1.35	1.5	25.3	13.4	0.054	0.702	0.378
4	0.1	2.9	1.5	1.8	21.2	11.5	0.047	0.724	0.3855
5	0.1	2.6	1.35	1.6	22.1	11.85	0.047	0.809	0.428
6	0	2.1	1.05	1.8	22.5	12.15	0.043	0.294	0.1685
7	0.1	2.1	1.1	2.6	26.7	14.65	0.05	0.642	0.346
8	0.1	1.5	0.8	7.8	25.2	16.5	0.048	0.637	0.3425
9	6.2	2.8	4.5	1.7	35.3	18.5	0.046	0.505	0.2755
10	0.5	2.2	1.35	2.3	18.8	10.55	0.05	0.402	0.226
11	0.2	3.8	2	1.7	34.1	17.9	0.059	0.584	0.3215
12	0.1	3.2	1.65	2	20.7	11.35	0.039	1	0.5195
13	0.1	4.5	2.3	2.1	22.6	12.35	0.046	0.818	0.432
14	0.1	5.6	2.85	2.4	19.4	10.9	0.041	0.79	0.4155
15	0.9	2.4	1.65	1.8	30.1	15.95	0.048	0.882	0.465
16	0.2	4.1	2.15	1.6	18.9	10.25	0.046	0.869	0.4575
17	0.1	3.3	1.7	1.3	55.7	28.5	0.044	1.148	0.596
18	0.1	4.2	2.15	1.5	21.7	11.6	0.052	1.091	0.5715
19	0.5	3.9	2.2	2	26.8	14.4	0.068	0.824	0.446
20	0.5	4	2.25	1.7	27.5	14.6	0.061	0.659	0.36
21	0.4	5.8	3.1	1.3	23.9	12.6	0.065	1.316	0.6905

22	0.8	5.1	2.95	1.6	39.7	20.65	0.046	1.193	0.6195
23	1.1	2.8	1.95	1.3	24.3	12.8	0.053	0.605	0.329
24	2.7	3.8	3.25	1.9	39.1	20.5	0.088	1.79	0.939
25	1.1	2.8	1.95	1.5	31	16.25	0.104	0.903	0.5035
26	1.3	1.4	1.35	1.7	54.5	28.1	0.059	0.754	0.4065
27	1.2	1.4	1.3	1.5	32.3	16.9	0.051	1.179	0.615
28	1.8	2.3	2.05	1.4	18.2	9.8	0.059	1.131	0.595
29	1.4	2.7	2.05	1.6	18.9	10.25	0.073	1.294	0.6835
30	1.2	3	2.1	1.2	33.3	17.25	0.045	1.072	0.5585
31	1.2	3.8	2.5	1.3	24.7	13	0.07	1.611	0.8405
32	1.2	3.7	2.45	3.2	41.9	22.55	0.073	1.182	0.6275
33	1.2	2.2	1.7	1.5	21.3	11.4	0.044	1.001	0.5225
34	1.1	2.6	1.85	3	26.6	14.8	0.052	1.051	0.5515
35	0.9	2.7	1.8	1.7	25.1	13.4	0.061	0.84	0.4505
36	0.8	2.5	1.65	1.8	30	15.9	0.035	0.826	0.4305
37	0.7	4.2	2.45	2	18.1	10.05	0.045	1.194	0.6195
38	0.6	4.1	2.35	3.1	20.2	11.65	0.053	1.397	0.725
39	0.6	2.9	1.75	1.6	17.7	9.65	0.038	0.849	0.4435
40	0.9	5.6	3.25	1.3	18.4	9.85	0.038	1.549	0.7935
41	0.5	2.6	1.55	1.2	28.7	14.95	0.084	1.455	0.7695
42	1	2.2	1.6	1.2	40.7	20.95	0.047	1.102	0.5745
43	0.7	2.4	1.55	1.3	38.8	20.05	0.048	1.514	0.781
44	1.1	3.6	2.35	1.1	23.1	12.1	0.047	1.073	0.56
45	0.8	3.8	2.3	1	28.2	14.6	0.05	1.703	0.8765
46	0.8	3.7	2.25	1.2	46.4	23.8	0.041	1.263	0.652
47	0.8	2.2	1.5	1.7	26.4	14.05	0.05	1.129	0.5895
48	1.5	3.3	2.4	1.1	19.7	10.4	0.046	0.913	0.4795
49	0.7	2.5	1.6	1.3	20.7	11	0.05	1.009	0.5295
50	0.6	2.4	1.5	1.2	19.8	10.5	1.463	1.463	1.463
51	0.6	2	1.3	1.3	12.7	7	1.361	1.361	1.361
52	0.5	1.7	1.1	1.7	19.2	10.45	1.156	1.156	1.156
53	0.5	2.2	1.35	1.9	12.4	7.15	0.976	0.976	0.976
54	0.5	1.7	1.1	1.6	20	10.8	1.649	1.649	1.649
55	0.6	2	1.3	1.4	19	10.2	1.06	1.06	1.06
56	0.5	2.7	1.6	1.1	22	11.55	1.102	1.102	1.102
57	0.5	1.6	1.05	1.1	15.3	8.2	1.226	1.226	1.226
58	0.4	2.5	1.45	1.9	14.7	8.3	1.564	1.564	1.564
59	0.5	3.2	1.85	1.2	16.9	9.05	1.038	1.038	1.038
60	0.5	2.6	1.55	30.1	30.1	30.1	1.13	1.13	1.13
61	0.5	2.4	1.45	9.1	9.1	9.1	0.952	0.952	0.952
62	0.6	2.3	1.45	13.5	13.5	13.5	0.894	0.894	0.894

63	0.6	1.9	1.25	15.2	15.2	15.2	1.006	1.006	1.006
64	0.5	1.6	1.05	13.2	13.2	13.2	0.794	0.794	0.794
65	0.4	2.3	1.35	8.2	8.2	8.2	1.108	1.108	1.108
66	0.4	2.7	1.55	17.5	17.5	17.5	0.904	0.904	0.904
67	0.7	2.9	1.8	14.9	14.9	14.9	0.713	0.713	0.713
68	0.7	3.2	1.95	23.1	23.1	23.1	0.725	0.725	0.725
69	0.7	3.6	2.15	17.6	17.6	17.6	0.88	0.88	0.88
70	0.7	2.4	1.55	38.9	38.9	38.9	1.226	1.226	1.226
71	0.6	3	1.8	24.6	24.6	24.6	0.882	0.882	0.882
72	0.6	3.5	2.05	24.4	24.4	24.4	0.854	0.854	0.854
73	0.6	2.1	1.35	21.6	21.6	21.6	0.7	0.7	0.7
74	0.6	3.1	1.85	25	25	25	0.67	0.67	0.67
75	0.8	2.9	1.85	28.5	28.5	28.5	0.711	0.711	0.711
76	1	2.2	1.6	18.3	18.3	18.3	0.916	0.916	0.916
77	0.7	5.2	2.95	24	24	24	0.924	0.924	0.924
78	1.1	2.6	1.85	18.3	18.3	18.3	0.601	0.601	0.601
79	0.8	2.8	1.8	15	15	15	1.384	1.384	1.384
80	1	3	2	32.5	32.5	32.5	1.978	1.978	1.978
81	0.7	2.2	1.45	59.9	59.9	59.9	1.545	1.545	1.545
82	1.2	2.6	1.9	33.8	33.8	33.8	1.597	1.597	1.597
83	1.2	2.6	1.9	38	38	38	1.244	1.244	1.244
84	0.8	2.6	1.7	20.4	20.4	20.4	1.069	1.069	1.069
85	0.9	1.5	1.2	30.5	30.5	30.5	0.906	0.906	0.906
86	1	2	1.5	22.1	22.1	22.1	1.462	1.462	1.462
87	0.8	2	1.4	21	21	21	1.579	1.579	1.579
88	1	8.7	4.85	44.5	44.5	44.5	1.338	1.338	1.338
89	0.6	2.5	1.55	13.7	13.7	13.7	0.842	0.842	0.842
90	1	2.4	1.7	21.6	21.6	21.6	0.8	0.8	0.8

Table: Set 2 data for channel one (output) conventional model

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
1	1.8	1.4	1.6	6.6	12.5	9.55	0.353	0.511	0.432
2	1.9	1.6	1.75	10.3	14.2	12.25	0.387	0.45	0.4185
3	3.3	1	2.15	7.2	9.1	8.15	0.366	0.579	0.4725
4	2.9	1	1.95	11.6	12	11.8	0.375	0.252	0.3135
5	2.2	1.3	1.75	9.1	10.3	9.7	0.416	0.505	0.4605
6	2.5	1.8	2.15	10.9	6.8	8.85	0.464	0.623	0.5435
7	2.2	2.5	2.35	10.2	13.8	12	0.473	0.709	0.591

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
8	2.4	2.5	2.45	7.8	9.6	8.7	0.096	0.451	0.2735
9	2	2.1	2.05	12.5	13.7	13.1	0.209	0.482	0.3455
10	2.4	2.2	2.3	14.3	10.3	12.3	0.344	0.442	0.393
11	1.6	2	1.8	13.2	10	11.6	0.066	0.425	0.2455
12	1.6	1.7	1.65	10.5	10.1	10.3	0.339	0.257	0.298
13	1.2	2.4	1.8	7.4	15	11.2	1.034	0.42	0.727
14	1.2	1.8	1.5	12.5	9.8	11.15	0.37	0.351	0.3605
15	1.3	2	1.65	7.1	15.9	11.5	0.265	0.356	0.3105
16	1.6	1.5	1.55	13.8	9.1	11.45	0.442	0.312	0.377
17	1.1	1.7	1.4	10.1	14.1	12.1	0.168	0.314	0.241
18	1.2	1.5	1.35	16.6	14	15.3	0.274	0.341	0.3075
19	1.6	1	1.3	12.3	11.2	11.75	0.51	0.222	0.366
20	1.2	0.8	1	11.9	28.2	20.05	0.193	0.432	0.3125
21	1.4	1.3	1.35	10	8.7	9.35	0.237	0.33	0.2835
22	1.6	1.1	1.35	7.8	11.9	9.85	0.382	0.363	0.3725
23	1.1	1	1.05	9.5	17.3	13.4	0.269	0.377	0.323
24	1.6	1	1.3	30.4	14.4	22.4	0.56	0.403	0.4815
25	1.5	1	1.25	21.7	12.2	16.95	0.211	0.411	0.311
26	1.1	0.9	1	12.6	16.6	14.6	0.28	0.428	0.354
27	1	1.1	1.05	16.4	12.7	14.55	0.679	0.334	0.5065
28	1.2	1	1.1	16.8	9.4	13.1	0.238	0.7	0.469
29	1.1	1.3	1.2	19.5	7.7	13.6	0.268	0.415	0.3415
30	1.1	1.1	1.1	15.6	12.3	13.95	0.41	0.318	0.364
31	0.9	1.1	1	15.6	13.8	14.7	0.307	0.487	0.397
32	0.8	0.9	0.85	19.6	8.4	14	0.41	0.395	0.4025
33	0.8	1.1	0.95	11.6	9.3	10.45	0.284	0.555	0.4195
34	1	0.8	0.9	10.5	12.1	11.3	0.336	0.579	0.4575
35	1.1	1	1.05	13.7	8.3	11	0.255	0.373	0.314
36	0.9	1	0.95	18.4	9.9	14.15	0.256	0.481	0.3685
37	0.8	1.1	0.95	18.6	6.1	12.35	0.384	0.457	0.4205
38	0.8	0.8	0.8	12	8.3	10.15	0.304	0.341	0.3225
39	0.8	0.8	0.8	14.5	9.4	11.95	0.356	0.433	0.3945
40	0.9	0.6	0.75	11.5	11.3	11.4	0.376	0.465	0.4205
41	0.9	0.8	0.85	14.3	13.1	13.7	0.264	0.322	0.293
42	0.7	0.8	0.75	5.6	9.2	7.4	0.263	0.377	0.32
43	0.9	0.6	0.75	8.1	6.9	7.5	0.438	0.732	0.585
44	1	0.8	0.9	9	8	8.5	0.25	0.571	0.4105
45	0.8	0.8	0.8	10.1	6.4	8.25	0.296	0.679	0.4875

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
46	0.6	0.7	0.65	9.7	10.7	10.2	0.383	0.571	0.477
47	1	0.9	0.95	10.5	8	9.25	0.763	0.456	0.6095
48	0.8	0.7	0.75	14.5	8.1	11.3	0.371	0.391	0.381
49	0.8	1.3	1.05	11.4	7.2	9.3	0.381	0.601	0.491
50	2	1	1.5	15.8	6.8	11.3	0.454	0.595	0.5245
51	1.1	1	1.05	10.6	7.9	9.25	0.65	0.573	0.6115
52	1.1	1.1	1.1	7.4	16.9	12.15	0.651	0.367	0.509
53	1	0.8	0.9	13.1	6.4	9.75	0.35	0.54	0.445
54	0.6	0.8	0.7	11.6	11.6	11.6	0.374	0.449	0.4115
55	0.4	0.8	0.6	14.3	8.4	11.35	0.302	0.792	0.547
56	0.5	1.1	0.8	11	6.2	8.6	0.338	0.559	0.4485
57	0.9	1.1	1	9.1	6.4	7.75	0.404	0.475	0.4395
58	1.1	1.1	1.1	5.5	7	6.25	0.298	1.03	0.664
59	1.4	1.4	1.4	11.5	7.4	9.45	0.371	0.26	0.3155
60	0.8	1.3	1.05	13.2	7.5	10.35	0.544	0.337	0.4405
61	0.4	1.3	0.85	10.5	5.4	7.95	0.409	0.138	0.2735
62	0.3	1.2	0.75	6.6	6.2	6.4	0.274	0.115	0.1945
63	1	1	1	8.2	8.3	8.25	0.263	0.332	0.2975
64	1.2	1.2	1.2	7.2	8.1	7.65	0.858	0.13	0.494
65	1	1	1	7.8	8.7	8.25	0.58	0.064	0.322
66	1.1	1.1	1.1	6.2	4.7	5.45	0.679	0.346	0.5125
67	1.3	1.3	1.3	11.3	6.2	8.75	1.191	0.295	0.743

Table: Set 2 data for channel two (input I) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
1	1	1.8	1.4	1.1	3.7	2.4	0.032	0.03	0.031
2	1.1	0.7	0.9	1.8	2.3	2.05	0.035	0.041	0.038
3	2.6	0.6	1.6	1.7	2.6	2.15	0.033	0.043	0.038
4	2.1	0.8	1.45	2.2	2.6	2.4	0.047	0.028	0.0375
5	1.7	1.4	1.55	1.5	2.6	2.05	0.035	0.048	0.0415
6	1.7	1.4	1.55	1.6	2.4	2	0.048	0.058	0.053
7	1.8	2.4	2.1	1.7	5.6	3.65	0.017	0.04	0.0285
8	1.8	2.9	2.35	1.5	2.1	1.8	0.001	0.039	0.02
9	1.7	2.1	1.9	2.6	2.2	2.4	0.002	0.052	0.027
10	1.6	2	1.8	2.3	2.8	2.55	0.002	0.054	0.028

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
11	1.3	2.3	1.8	2.2	3.1	2.65	0	0.05	0.025
12	1.5	1.7	1.6	1.8	2.4	2.1	0.012	0.031	0.0215
13	0.9	1.9	1.4	1.5	2.9	2.2	0.003	0.03	0.0165
14	0.9	1.6	1.25	1.7	2	1.85	0	0.036	0.018
15	0.7	2	1.35	1.7	4.1	2.9	0.014	0.027	0.0205
16	0.9	1.5	1.2	2.1	3.9	3	0.033	0.027	0.03
17	0.8	1.4	1.1	2.1	2.6	2.35	0.017	0.026	0.0215
18	0.7	1.6	1.15	1.8	4.3	3.05	0.018	0.031	0.0245
19	0.9	0.9	0.9	2.6	3	2.8	0.019	0.029	0.024
20	0.8	0.8	0.8	2.5	2.6	2.55	0.018	0.032	0.025
21	0.8	1	0.9	1.8	3.1	2.45	0.02	0.033	0.0265
22	1	0.9	0.95	1.7	2.9	2.3	0.021	0.032	0.0265
23	0.6	0.7	0.65	2.1	4	3.05	0.024	0.023	0.0235
24	0.9	0.8	0.85	2.1	2.5	2.3	0.03	0.036	0.033
25	0.8	0.7	0.75	3.1	3	3.05	0.016	0.031	0.0235
26	0.7	0.7	0.7	2.8	12	7.4	0.018	0.036	0.027
27	0.8	0.7	0.75	2.7	1.8	2.25	0.046	0.04	0.043
28	0.8	0.6	0.7	4.3	1.3	2.8	0.019	0.036	0.0275
29	0.8	0.7	0.75	5.2	1.3	3.25	0.023	0.033	0.028
30	0.9	0.7	0.8	7.1	2.7	4.9	0.027	0.018	0.0225
31	0.7	0.7	0.7	2.6	2.4	2.5	0.023	0.05	0.0365
32	0.5	0.6	0.55	3.1	2.1	2.6	0.018	0.046	0.032
33	0.6	0.7	0.65	3.2	2.5	2.85	0.018	0.036	0.027
34	0.6	0.6	0.6	2.5	2.2	2.35	0.025	0.055	0.04
35	0.7	0.9	0.8	2.1	2.5	2.3	0.019	0.034	0.0265
36	0.6	0.7	0.65	2.8	1.5	2.15	0.015	0.032	0.0235
37	0.5	0.7	0.6	2.3	2.1	2.2	0.035	0.04	0.0375
38	0.6	0.6	0.6	2.3	1.9	2.1	0.029	0.04	0.0345
39	0.6	0.7	0.65	2.9	2.4	2.65	0.017	0.039	0.028
40	0.7	0.5	0.6	4.1	2.5	3.3	0.018	0.051	0.0345
41	0.7	0.6	0.65	1.9	3	2.45	0.023	0.034	0.0285
42	0.5	0.6	0.55	1.6	1.9	1.75	0.023	0.035	0.029
43	0.6	0.5	0.55	1.7	2.3	2	0.042	0.038	0.04
44	0.7	0.6	0.65	3	1.7	2.35	0.023	0.033	0.028
45	0.6	0.6	0.6	1.9	1.8	1.85	0.025	0.046	0.0355
46	0.4	0.5	0.45	2	2.2	2.1	0.025	0.051	0.038
47	0.6	1	0.8	2.5	1.8	2.15	0.07	0.035	0.0525
48	0.6	0.8	0.7	5.2	2	3.6	0.028	0.042	0.035

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
49	0.6	0.9	0.75	3.1	1.2	2.15	0.021	0.04	0.0305
50	0.6	1	0.8	2.3	1.6	1.95	0.03	0.045	0.0375
51	0.7	0.9	0.8	2.6	1.7	2.15	0.038	0.04	0.039
52	0.7	0.8	0.75	2.3	1.3	1.8	0.044	0.052	0.048
53	0.4	0.7	0.55	1.7	1.6	1.65	0.02	0.037	0.0285
54	0.3	0.5	0.4	2.8	2.2	2.5	0.027	0.039	0.033
55	0.3	0.7	0.5	3.6	2.6	3.1	0.014	0.065	0.0395
56	0.2	0.8	0.5	2.1	1.1	1.6	0.03	0.045	0.0375
57	0.5	1	0.75	2.4	1	1.7	0.033	0.047	0.04
58	0.6	1.1	0.85	1.3	1.5	1.4	0.081	0.072	0.0765
59	0.7	1.2	0.95	2	1.2	1.6	0.027	0.022	0.0245
60	0.5	1.2	0.85	2	1.2	1.6	0.037	0.004	0.0205
61	0.3	1.3	0.8	1.5	1.5	1.5	0.02	0.002	0.011
62	0.1	1.1	0.6	1.5	1.2	1.35	0.021	0.001	0.011
63	0.9	0.9	0.9	1.8	2.3	2.05	0.018	0.003	0.0105
64	1.1	1.1	1.1	1.4	2.8	2.1	0.023	0.001	0.012
65	1	1	1	2.1	1.3	1.7	0.053	0	0.0265
66	1	1	1	1.5	1.1	1.3	0.038	0.044	0.041
67	1	1	1	2.1	1.6	1.85	0.051	0.022	0.0365

Table: Set 2 data for channel three (input II) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
1	6.2	3.4	4.8	17.6	21.7	19.65	0.76	0.979	0.8695
2	4.3	4.5	4.4	33.6	27.5	30.55	1.075	1.151	1.113
3	7.8	4	5.9	18.8	26.2	22.5	1.299	0.904	1.1015
4	15.8	2.3	9.05	17.6	29.8	23.7	0.847	0.703	0.775
5	6	3.5	4.75	24.3	20.1	22.2	1.131	1.214	1.1725
6	7.3	4.6	5.95	23.1	24.9	24	1.65	1.294	1.472
7	5.9	5.1	5.5	20.4	32.4	26.4	0.503	1.058	0.7805
8	7.2	14.9	11.05	21.8	27.1	24.45	0.046	0.814	0.43
9	6.1	17.5	11.8	46.8	25.8	36.3	0.072	0.934	0.503
10	3.7	4.4	4.05	20.1	29.6	24.85	0.187	1.034	0.6105
11	5.2	6.5	5.85	38.9	28.5	33.7	0.025	1.093	0.559
12	4.2	4.2	4.2	32.5	30.4	31.45	0.391	1.101	0.746
13	3.1	8.4	5.75	18.5	36.3	27.4	0.099	1.235	0.667

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
14	2.9	7.8	5.35	14.4	29	21.7	0.018	0.745	0.3815
15	2.7	7.8	5.25	14.2	71.7	42.95	0.393	0.778	0.5855
16	2.9	4.4	3.65	25.3	31.3	28.3	0.622	0.735	0.6785
17	2.6	4.9	3.75	26.8	28.2	27.5	0.371	0.697	0.534
18	2.6	4.3	3.45	22.9	30.9	26.9	0.49	0.929	0.7095
19	3.8	2.5	3.15	38	14	26	0.994	0.798	0.896
20	3	2.7	2.85	21	29.5	25.25	0.496	0.93	0.713
21	2	3.9	2.95	26.3	32.9	29.6	0.573	0.844	0.7085
22	4.7	2.6	3.65	26.4	39.7	33.05	0.736	1.013	0.8745
23	3.5	3.1	3.3	25.6	69.6	47.6	0.942	0.669	0.8055
24	3.2	2.3	2.75	26.4	30.6	28.5	0.846	1.006	0.926
25	2.1	2.5	2.3	41.7	75.2	58.45	0.598	0.785	0.6915
26	2.6	2.1	2.35	38.3	43.8	41.05	0.552	1.09	0.821
27	2.3	2.3	2.3	27.8	40.9	34.35	1.362	1.004	1.183
28	2.5	2.7	2.6	99	14.6	56.8	0.471	1.042	0.7565
29	2.5	3.5	3	85.6	15.6	50.6	0.594	0.901	0.7475
30	3.3	2.1	2.7	49	23.2	36.1	0.737	0.407	0.572
31	2	2.5	2.25	34.4	27.9	31.15	0.499	1.29	0.8945
32	2	1.6	1.8	30.7	18.9	24.8	0.664	0.829	0.7465
33	2.6	2.1	2.35	17.5	22.6	20.05	0.574	1.095	0.8345
34	2.3	1.5	1.9	30.4	22.4	26.4	0.545	1.194	0.8695
35	2.8	2.4	2.6	38.3	15.7	27	0.484	1.235	0.8595
36	2.8	2.4	2.6	73.4	17.4	45.4	0.522	0.815	0.6685
37	1.9	2.2	2.05	23.6	14.6	19.1	0.811	1.271	1.041
38	2.8	2.9	2.85	36.2	32.6	34.4	0.717	1.056	0.8865
39	2.2	3.1	2.65	31.2	15.5	23.35	0.489	1.418	0.9535
40	2.4	1.4	1.9	70.7	13.4	42.05	0.465	0.998	0.7315
41	2.3	1.9	2.1	25.3	26.6	25.95	0.441	0.785	0.613
42	1.9	2.3	2.1	10.2	29.4	19.8	0.527	1.08	0.8035
43	2.8	1.6	2.2	14.8	28.6	21.7	1.036	0.962	0.999
44	1.9	1.7	1.8	29.7	17.7	23.7	0.49	1.094	0.792
45	1.7	2.7	2.2	24.3	31.3	27.8	0.642	1.468	1.055
46	1.2	2.2	1.7	26.2	31.4	28.8	0.76	1.235	0.9975
47	2.6	2.2	2.4	25.7	22.7	24.2	1.682	1.055	1.3685
48	2.4	1.7	2.05	36.9	20	28.45	0.756	1.206	0.981
49	1.9	2.8	2.35	18.7	19	18.85	0.648	0.954	0.801
50	2	3.5	2.75	26.4	18.6	22.5	0.701	1.443	1.072
51	2	2.8	2.4	23.4	21	22.2	0.816	.895	0.908

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
52	4.1	3.1	3.6	25.7	20.8	23.25	1.187	1.261	1.224
53	2.3	2	2.15	23.6	35.2	29.4	0.663	0.813	0.738
54	0.6	1.5	1.05	45.6	31.2	38.4	0.564	0.687	0.6255
55	0.4	1.8	1.1	33.5	15.1	24.3	0.571	0.9	0.786
56	0.5	2.3	1.4	21.1	11.8	16.45	0.743	1.223	0.983
57	2.7	2.7	2.7	13.7	13.6	13.65	0.777	1.071	0.924
58	2.6	4.6	3.6	17.1	15.1	16.1	1.093	1.89	1.4915
59	3.5	3.6	3.55	88.3	14.1	51.2	0.791	0.604	0.6975
60	1.9	2.9	2.4	47.8	13.3	30.55	0.849	0.2	0.5245
61	0.5	2.8	1.65	28.2	13.5	20.85	0.646	0.051	0.3485
62	0.2	3.1	1.65	17.1	23.7	20.4	0.775	0.086	0.4305
63	3	3	3	12.2	28.9	20.55	0.787	0.122	0.4545
64	3.6	3.6	3.6	10.9	29.5	20.2	0.533	0.051	0.292
65	2.5	2.5	2.5	11	18.4	14.7	0.919	0.023	0.471
66	3.4	3.4	3.4	24.5	12.8	18.65	1.116	1.494	1.305
67	3.9	3.9	3.9	24.9	20.3	22.6	1.149	0.543	0.846

Table: Set 3 data for channel one (output) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
1	0.8	1.4	1.1	8.9	9.6	9.25	0.02	0.022	0.021
2	1.7	1.1	1.4	7.6	14.4	11	0.573	0.058	0.3155
3	1	1.8	1.4	12.9	11.9	12.4	0.237	0.292	0.2645
4	1	0.9	0.95	10.3	7.8	9.05	0.043	0.504	0.2735
5	1.1	1.2	1.15	18.1	8.6	13.35	0.25	0.452	0.351
6	1.5	1.5	1.5	11.4	7.4	9.4	0.883	0.497	0.69
7	1	1.1	1.05	11.6	7.2	9.4	0.449	0.45	0.4495
8	2	1.9	1.95	24.2	9.2	16.7	0.473	0.563	0.518
9	2.1	1.6	1.85	13.6	7.8	10.7	0.332	0.414	0.373
10	2.7	1.4	2.05	9.7	8.4	9.05	0.516	0.551	0.5335
11	1.4	1.2	1.3	8.6	8.5	8.55	0.371	0.693	0.532
12	1.8	1.5	1.65	10.7	13.8	12.25	0.344	0.504	0.424
13	1.7	2.1	1.9	10.8	10.3	10.55	0.394	1.158	0.776
14	1.8	1.9	1.85	16.4	9.3	12.85	0.542	0.465	0.5035
15	1.9	1.9	1.9	19.6	6.6	13.1	0.615	0.739	0.677
16	1.6	2.2	1.9	7.5	7.8	7.65	0.408	0.945	0.6765

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
17	1.6	1.5	1.55	7.8	10.8	9.3	0.611	0.546	0.5785
18	1.7	2.3	2	6.3	13.5	9.9	0.567	0.582	0.5745
19	1.3	1.6	1.45	12.3	10.8	11.55	0.549	0.488	0.5185
20	1.3	1.5	1.4	9.3	9	9.15	0.633	0.672	0.6525
21	1	1.8	1.4	12.2	14.3	13.25	0.502	0.389	0.4455
22	0.9	1.1	1	21.1	12.8	16.95	0.683	0.654	0.6685
23	2.5	1.1	1.8	27.4	8.9	18.15	0.448	0.578	0.513
24	1.3	1	1.15	12.5	11.1	11.8	0.636	0.932	0.784
25	1.3	0.9	1.1	13.1	10.4	11.75	0.469	0.53	0.4995
26	1.1	0.8	0.95	7.3	14.9	11.1	0.455	0.466	0.4605
27	1.1	1.1	1.1	11.5	16.2	13.85	0.673	0.45	0.5615
28	0.9	0.9	0.9	15.2	9.5	12.35	0.378	0.521	0.4495
29	1.2	0.7	0.95	8.9	18.2	13.55	0.419	0.33	0.3745
30	1.2	0.8	1	16.5	7.5	12	0.568	0.537	0.5525
31	1.2	1.1	1.15	11.8	12.8	12.3	0.375	0.648	0.5115
32	1.2	1	1.1	13.5	11.4	12.45	0.387	0.55	0.4685
33	1.3	1.6	1.45	18.2	16.3	17.25	0.406	1.144	0.775
34	1.3	1.5	1.4	5.7	7.6	6.65	0.64	0.676	0.658
35	1.9	1.1	1.5	9.7	8.2	8.95	0.726	0.871	0.7985
36	1.9	1.5	1.7	9.3	10.9	10.1	0.466	1.071	0.7685
37	1.3	2	1.65	8.6	14.1	11.35	0.451	0.433	0.442
38	2.1	1.1	1.6	18.4	8.3	13.35	0.634	0.23	0.432
39	1.4	1.1	1.25	6.9	8.6	7.75	1.708	0.448	1.078
40	1.5	1.6	1.55	6.2	10.4	8.3	0.71	0.667	0.6885
41	0.7	1.2	0.95	13.4	9.7	11.55	0.412	0.463	0.4375
42	1.2	1.1	1.15	8.1	8.7	8.4	0.529	1.038	0.7835
43	0.9	1.3	1.1	12.5	12.3	12.4	0.419	0.482	0.4505
44	0.9	1	0.95	8.7	11.5	10.1	0.333	0.405	0.369
45	0.9	0.8	0.85	16.2	8.3	12.25	0.894	0.663	0.7785
46	0.9	0.9	0.9	14.3	10.9	12.6	0.594	0.533	0.5635
47	1	0.9	0.95	13.9	8.9	11.4	0.339	0.399	0.369
48	0.9	0.9	0.9	14.7	9.4	12.05	0.452	1.526	0.989
49	0.8	0.9	0.85	13.3	10.8	12.05	0.343	0.452	0.3975
50	0.9	0.7	0.8	12.7	6.1	9.4	0.331	0.843	0.587
51	1.1	0.8	0.95	9.4	7.6	8.5	0.464	0.358	0.411
52	0.9	0.7	0.8	17.6	8.5	13.05	0.824	0.889	0.8565
53	1.2	0.8	1	10.5	8.6	9.55	0.532	0.524	0.528
54	0.8	0.9	0.85	7	9.6	8.3	1.095	1.341	1.218

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
55	1.1	0.9	1	9.7	12.4	11.05	0.443	0.977	0.71
56	0.9	0.8	0.85	6.9	6.9	6.9	0.822	0.728	0.775
57	0.9	0.8	0.85	7.5	13	10.25	0.372	1.19	0.781
58	0.7	0.8	0.75	6.7	19.6	13.15	0.612	0.811	0.7115
59	0.9	0.7	0.8	6.8	11.3	9.05	1.204	0.972	1.088
60	1.1	0.7	0.9	8.5	8.3	8.4	0.985	0.701	0.843
61	1	0.8	0.9	7.7	16.2	11.95	0.741	0.436	0.5885
62	2.2	0.9	1.55	8.2	8.8	8.5	1.035	0.056	0.5455
63	1.3	0.9	1.1	5	6.4	5.7	0.992	0.992	0.992
64	1.2	0.9	1.05	9	9.3	9.15	0.95	0.95	0.95
65	1.1	1.3	1.2	5.6	8.1	6.85	0.8	0.8	0.8
66	1.1	1.1	1.1	7	8.2	7.6	0.084	0.084	0.084
67	0.8	0.8	0.8	9.7	9.6	9.65	0.017	0.017	0.017
68	1.3	0.9	1.1	10.6	8.4	9.5	0.015	0.015	0.015
69	1	0.9	0.95	3.4	7.2	5.3	0.017	0.017	0.017
70	1.2	0.9	1.05	8.9	7.6	8.25	0.015	0.015	0.015

Table: Set 3 data for channel two (input I) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
1	0.7	0.6	0.65	2.7	2.4	2.55	0.001	0	0.0005
2	1.1	0.6	0.85	1.8	2.9	2.35	0.003	0.001	0.002
3	0.7	1.5	1.1	2.5	2.2	2.35	0.004	0.023	0.0135
4	0.7	0.7	0.7	3.8	1.7	2.75	0.001	0.019	0.01
5	0.8	1	0.9	3.8	1.5	2.65	0.015	0.029	0.022
6	1	1.1	1.05	2.3	1.4	1.85	0.033	0.022	0.0275
7	0.8	0.7	0.75	2.8	1.7	2.25	0.023	0.025	0.024
8	1.4	1.8	1.6	3.2	1.6	2.4	0.024	0.023	0.0235
9	1.9	1.4	1.65	3	2	2.5	0.018	0.028	0.023
10	2.3	1.2	1.75	2.9	1.6	2.25	0.025	0.032	0.0285
11	1.1	1.1	1.1	1.8	2.2	2	0.03	0.029	0.0295
12	1.3	1.3	1.3	2.3	4.3	3.3	0.022	0.036	0.029
13	1.5	1.4	1.45	5.6	1.8	3.7	0.023	0.068	0.0455
14	1.4	1.3	1.35	3	1.7	2.35	0.031	0.032	0.0315
15	1.7	1.7	1.7	4.4	1.5	2.95	0.033	0.042	0.0375
16	1.4	1.5	1.45	3.1	1.8	2.45	0.032	0.042	0.037

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
17	1.5	1.1	1.3	1.4	1.9	1.65	0.026	0.051	0.0385
18	1.4	1.5	1.45	1.9	3	2.45	0.026	0.034	0.03
19	1.1	1	1.05	2.2	3.3	2.75	0.024	0.025	0.0245
20	1	1.1	1.05	2.7	2.6	2.65	0.046	0.039	0.0425
21	1.1	0.9	1	2.9	3.3	3.1	0.031	0.029	0.03
22	0.7	0.9	0.8	3.5	1.7	2.6	0.024	0.038	0.031
23	0.8	0.8	0.8	2.8	2.4	2.6	0.026	0.023	0.0245
24	0.6	0.8	0.7	2.3	1.9	2.1	0.032	0.087	0.0595
25	0.7	0.6	0.65	1.9	2.1	2	0.023	0.036	0.0295
26	0.9	0.6	0.75	1.5	3.1	2.3	0.028	0.023	0.0255
27	0.8	0.6	0.7	1.7	2.7	2.2	0.06	0.019	0.0395
28	0.6	0.6	0.6	2.8	2.5	2.65	0.031	0.029	0.03
29	0.7	0.6	0.65	2	2.7	2.35	0.021	0.034	0.0275
30	0.9	0.6	0.75	2.1	3.2	2.65	0.023	0.028	0.0255
31	0.9	0.7	0.8	2	3.2	2.6	0.022	0.022	0.022
32	0.9	0.7	0.8	1.9	2.3	2.1	0.02	0.045	0.0325
33	1	0.7	0.85	2.3	2.2	2.25	0.021	0.117	0.069
34	0.8	0.8	0.8	1.3	1.5	1.4	0.022	0.024	0.023
35	0.9	0.8	0.85	2	2.2	2.1	0.028	0.04	0.034
36	0.7	1	0.85	1.9	2.1	2	0.045	0.029	0.037
37	0.9	0.9	0.9	1.9	2.6	2.25	0.024	0.019	0.0215
38	1	1	1	2.1	1.9	2	0.037	0.015	0.026
39	1	0.9	0.95	1.6	2	1.8	0.122	0.018	0.07
40	1	1	1	2.2	1.9	2.05	0.029	0.045	0.037
41	0.6	1	0.8	1.7	3.1	2.4	0.025	0.025	0.025
42	0.5	0.8	0.65	1.4	2	1.7	0.023	0.042	0.0325
43	0.7	0.9	0.8	2.7	1.9	2.3	0.032	0.027	0.0295
44	0.6	0.8	0.7	2.1	2.5	2.3	0.015	0.018	0.0165
45	0.7	0.7	0.7	3.4	1.8	2.6	0.098	0.037	0.0675
46	0.7	0.6	0.65	1.7	2.9	2.3	0.05	0.034	0.042
47	0.7	0.7	0.7	2.9	2	2.45	0.025	0.021	0.023
48	0.7	0.7	0.7	2.1	1.9	2	0.03	0.109	0.0695
49	0.7	0.7	0.7	3.6	2.4	3	0.015	0.04	0.0275
50	0.7	0.7	0.7	3.1	1.6	2.35	0.024	0.042	0.033
51	1	0.6	0.8	2.1	1.6	1.85	0.021	0.032	0.0265
52	0.9	0.6	0.75	1.9	1.9	1.9	0.047	0.082	0.0645
53	0.9	0.7	0.8	1.3	1.5	1.4	0.03	0.053	0.0415
54	0.8	0.7	0.75	1.6	2.2	1.9	0.049	0.079	0.064

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
55	0.8	0.7	0.75	1.3	2.3	1.8	0.04	0.096	0.068
56	0.7	0.6	0.65	1.2	1.9	1.55	0.061	0.052	0.0565
57	0.8	0.6	0.7	1.6	3.2	2.4	0.022	0.071	0.0465
58	0.5	0.7	0.6	1.1	2.2	1.65	0.04	0.077	0.0585
59	0.8	0.5	0.65	1.6	2.4	2	0.074	0.083	0.0785
60	0.9	0.5	0.7	1.5	1.5	1.5	0.06	0.04	0.05
61	0.9	0.7	0.8	1.4	1.4	1.4	0.072	0.015	0.0435
62	1.1	0.7	0.9	1.6	2.1	1.85	0.074	0.001	0.0375
63	0.9	0.8	0.85	1.3	1.6	1.45	0.075	0.075	0.075
64	0.9	0.8	0.85	1.8	2.1	1.95	0.056	0.056	0.056
65	1	1	1	1.3	1.5	1.4	0.053	0.053	0.053
66	0.9	0.8	0.85	1.6	1.7	1.65	0.003	0.003	0.003

Table: Set 3 data for channel three (input II) conventional model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
1	2.4	3	2.7	20.6	20.6	20.6	0.009	0.009	0.009
2	5	2.4	3.7	23.6	34.5	29.05	0.13	0.035	0.0825
3	2.7	12.4	7.55	27.3	37.4	32.35	0.392	0.547	0.4695
4	2.3	2.3	2.3	41.6	18.7	30.15	0.045	0.477	0.261
5	2.3	2.3	2.3	56	22.5	39.25	0.303	0.652	0.4775
6	2.6	3.2	2.9	26	17	21.5	0.721	0.544	0.6325
7	3.1	3.7	3.4	25.1	19.8	22.45	0.777	0.584	0.6805
8	3.3	8.1	5.7	59.3	25.1	42.2	0.93	0.859	0.8945
9	7.2	4.3	5.75	33.2	22.8	28	0.791	0.705	0.748
10	9	5.8	7.4	16.5	19.3	17.9	0.732	0.768	0.75
11	3.4	5	4.2	17.7	29.2	23.45	0.662	1.171	0.9165
12	9.9	5	7.45	41.7	121.1	81.4	0.601	0.787	0.694
13	4.8	12.7	8.75	40.8	14.1	27.45	0.617	9999	0.809
14	5	4.9	4.95	21.5	31.8	26.65	1.047	0.669	0.858
15	7.5	6.6	7.05	34.2	20.9	27.55	1	1.191	1.0955
16	4.9	5.4	5.15	17.3	24.2	20.75	0.751	1.09	0.9205
17	4.4	4.7	4.55	20.1	27.7	23.9	0.753	0.826	0.7895
18	4.4	7	5.7	15.9	37.3	26.6	0.968	0.737	0.8525
19	3.4	4.9	4.15	35.1	51.2	43.15	0.936	0.5	0.718
20	3.4	4.9	4.15	18.2	34.3	26.25	0.787	0.971	0.879

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
21	3.3	2.4	2.85	40.2	31.2	35.7	0.783	0.664	0.7235
22	2.2	2.8	2.5	22.5	29.1	25.8	0.856	0.757	0.8065
23	4.6	3.1	3.85	27.1	27	27.05	0.579	0.812	0.6955
24	2.7	2.5	2.6	22.6	29.6	26.1	0.889	1.504	1.1965
25	2	2.9	2.45	14.3	26.2	20.25	0.824	0.796	0.81
26	2.3	2.9	2.6	15	35.5	25.25	0.915	0.511	0.713
27	3.7	2.3	3	17	28.6	22.8	1.29	0.547	0.9185
28	2.3	3	2.65	19.8	23.6	21.7	0.692	0.622	0.657
29	2.2	2.6	2.4	22.2	49.4	35.8	0.856	0.655	0.7555
30	2.1	1.8	1.95	16.7	24.3	20.5	0.587	0.504	0.5455
31	2.2	3.5	2.85	22.2	21	21.6	0.722	1.21	0.966
32	3.8	2.1	2.95	21.6	39	30.3	0.583	0.853	0.718
33	2.2	2.5	2.35	14.1	32	23.05	0.651	0.999	0.826
34	2.3	5.7	4	9.2	17.7	13.45	0.842	1.057	0.9495
35	3.8	2.9	3.35	24.5	55.5	40	0.882	1.058	0.97
36	3	5.7	4.35	19.9	50.7	35.3	0.923	0.743	0.833
37	4.7	3.3	4	23.5	33.2	28.35	1.018	0.723	0.8705
38	2.6	2.4	2.5	19.7	25.7	22.7	0.889	0.394	0.6415
39	2.5	2.4	2.45	15.8	25	20.4	1.928	0.662	1.295
40	3.7	2.5	3.1	17.4	19.2	18.3	0.71	1.207	0.9585
41	1.6	2.2	1.9	16.9	27.8	22.35	0.606	0.617	0.6115
42	2.8	2.3	2.55	16.5	27.4	21.95	0.557	1.501	1.029
43	2	2.8	2.4	26.9	23.9	25.4	1.167	0.712	0.9395
44	2.1	2.2	2.15	19	31.7	25.35	0.366	0.72	0.543
45	2.2	2.3	2.25	31.4	20.1	25.75	0.999	0.921	0.961
46	2.4	1.8	2.1	28.1	34	31.05	1.029	0.781	0.905
47	1.8	3.6	2.7	24.6	23.3	23.95	0.666	0.472	0.569
48	2.3	2.1	2.2	74.7	30.9	52.8	0.826	1.137	0.9815
49	2.9	2.2	2.55	23.6	33.2	28.4	0.455	1.326	0.8905
50	1.9	1.9	1.9	16	14.3	15.15	0.731	1.007	0.869
51	2.5	2	2.25	19.7	22.7	21.2	0.521	0.535	0.528
52	2.5	1.7	2.1	22.7	17.3	20	1.854	1.967	1.9105
53	2.5	2.1	2.3	12.6	15.1	13.85	1.478	0.74	1.109
54	2.2	2.4	2.3	17.1	24.4	20.75	0.999	1.787	0.394
55	2.8	2.2	2.5	16.5	18	17.25	0.848	1.757	1.3025
56	2.3	1.6	1.95	18.5	23.2	20.85	0.999	1.311	0.156
57	1.6	2.1	1.85	22.5	14.4	18.45	0.712	1.657	1.1845
58	1.6	1.9	1.75	15.2	31.3	23.25	1.026	1.091	1.0585

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
59	2	1.3	1.65	18.5	26.4	22.45	0.999	1.626	0.313
60	2.4	4	3.2	20.4	18.4	19.4	1.922	1.239	1.5805
61	2.5	2.2	2.35	17.3	18.2	17.75	1.414	0.232	0.823
62	4.2	1.9	3.05	23.4	15.3	19.35	1.788	0.1	0.944
63	3.3	2.3	2.8	8.6	15.5	12.05	1.818	1.818	1.818
64	2.1	2.2	2.15	18.9	22.4	20.65	1.318	1.318	1.318
65	3.1	2.6	2.85	13.1	16.4	14.75	1.339	1.339	1.339
66	2.3	2.4	2.35	17.4	18.9	18.15	0.139	0.139	0.139
67	1.9	1.8	1.85	12.4	14.9	13.65	0.018	0.018	0.018
68	3	2.1	2.55	16.2	14.1	15.15	0.01	0.01	0.01
69	3	2.3	2.65	9.7	18.8	14.25	0.014	0.014	0.014
70	3.3	2.3	2.8	22.4	16.7	19.55	0.01	0.01	0.01

Table: Set 1 data for channel one (output) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
1	0.1	0.1	0.1	0.1	0.1	0.1	0.003	0.001	0.002
2	0.1	0.1	0.1	0.3	0.1	0.2	0.003	0.001	0.002
3	0.1	0.1	0.1	0.3	0.6	0.45	0.003	0.018	0.0105
4	0.1	0.1	0.1	0.3	1.6	0.95	0.017	0.015	0.016
5	0.4	0.3	0.35	0.6	0.5	0.55	0.01	0.031	0.0205
6	0.4	0.6	0.5	0.7	0.5	0.6	0.011	0.079	0.045
7	0.2	0.3	0.25	0.5	0.9	0.7	0.014	0.069	0.0415
8	0.3	0.3	0.3	0.6	0.9	0.75	0.014	0.048	0.031
9	0.3	0.4	0.35	0.6	0.6	0.6	0.04	0.024	0.032
10	0.3	0.3	0.3	0.4	0.6	0.5	0.034	0.044	0.039
11	0.3	0.3	0.3	0.6	0.7	0.65	0.047	0.085	0.066
12	0.7	0.5	0.6	0.7	0.8	0.75	0.046	0.022	0.034
13	0.3	0.3	0.3	0.4	0.9	0.65	0.048	0.043	0.0455
14	0.7	0.3	0.5	0.9	0.8	0.85	0.03	0.047	0.0385
15	0.5	0.3	0.4	1	0.5	0.75	0.02	0.02	0.02
16	0.3	0.3	0.3	1	0.5	0.75	0.022	0.027	0.0245
17	0.5	0.6	0.55	1	0.4	0.7	0.019	0.017	0.018
18	0.4	0.6	0.5	0.6	0.8	0.7	0.018	0.028	0.023
19	0.3	2.3	1.3	0.6	0.6	0.6	0.021	0.031	0.026
20	0.3	3.6	1.95	0.7	1.3	1	0.023	0.035	0.029

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
21	0.4	1.1	0.75	0.6	0.6	0.6	0.023	0.023	0.023
22	0.5	1.4	0.95	0.8	0.7	0.75	0.019	0.029	0.024
23	0.3	1.3	0.8	0.6	1.2	0.9	0.019	0.027	0.023
24	0.5	1.3	0.9	0.5	1.1	0.8	0.019	0.039	0.029
25	0.3	1.3	0.8	1.2	1.2	1.2	0.026	0.027	0.0265
26	0.3	0.7	0.5	0.6	0.8	0.7	0.023	0.02	0.0215
27	0.3	0.5	0.4	0.9	0.7	0.8	0.021	0.087	0.054
28	0.6	0.8	0.7	0.6	0.5	0.55	0.024	0.08	0.052
29	0.4	0.4	0.4	0.8	0.6	0.7	0.016	0.033	0.0245
30	0.2	0.4	0.3	0.9	0.5	0.7	0.023	0.077	0.05
31	0.3	0.8	0.55	0.7	0.6	0.65	0.017	0.101	0.059
32	0.4	0.6	0.5	0.5	1.9	1.2	0.02	0.044	0.032
33	0.3	1	0.65	1.1	1.1	1.1	0.016	0.074	0.045
34	0.3	0.7	0.5	0.6	0.7	0.65	0.011	0.029	0.02
35	0.3	0.7	0.5	1	0.9	0.95	0.026	0.056	0.041
36	0.2	1.2	0.7	0.7	0.8	0.75	0.021	0.112	0.0665
37	0.2	1.1	0.65	0.5	1.1	0.8	0.01	0.05	0.03
38	0.6	1.4	1	0.7	2.3	1.5	0.039	0.034	0.0365
39	0.6	0.5	0.55	1	0.9	0.95	0.023	0.021	0.022
40	0.8	0.5	0.65	1	0.9	0.95	0.014	0.025	0.0195
41	0.5	0.6	0.55	0.9	0.7	0.8	0.014	0.111	0.0625
42	0.3	0.3	0.3	1	1.3	1.15	0.031	0.064	0.0475
43	0.7	0.3	0.5	1	1	1	0.034	0.052	0.043
44	0.4	0.3	0.35	1.1	0.9	1	0.021	0.04	0.0305
45	0.7	0.4	0.55	0.7	1	0.85	0.019	0.032	0.0255
46	0.4	0.3	0.35	1	0.6	0.8	0.044	0.032	0.038
47	0.3	0.3	0.3	0.8	0.6	0.7	0.015	0.033	0.024
48	0.5	0.2	0.35	0.8	1.2	1	0.033	0.134	0.0835
49	0.4	0.3	0.35	0.8	0.8	0.8	0.028	0.087	0.0575
50	0.6	0.3	0.45	0.7	0.7	0.7	0.029	0.062	0.0455
51	0.3	0.4	0.35	0.7	1.4	1.05	0.037	0.047	0.042
52	1	0.3	0.65	1	0.7	0.85	0.035	0.086	0.0605
53	0.3	0.3	0.3	0.6	0.8	0.7	0.015	0.07	0.0425
54	0.3	0.4	0.35	0.5	0.9	0.7	0.042	0.078	0.06
55	0.3	0.3	0.3	0.7	0.5	0.6	0.015	0.06	0.0375
56	0.2	0.3	0.25	0.7	0.3	0.5	0.038	0.051	0.0445
57	0.2	0.2	0.2	0.6	0.3	0.45	0.049	0.043	0.046
58	0.4	0.7	0.55	0.6	0.1	0.35	0.021	0.101	0.061

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
59	0.2	0.5	0.35	0.8	0.8	0.8	0.021	0.059	0.04
60	0.3	0.5	0.4	0.7	0.7	0.7	0.021	0.068	0.0445
61	0.4	0.3	0.35	0.7	0.7	0.7	0.031	0.136	0.0835
62	0.3	0.5	0.4	0.6	0.6	0.6	0.02	0.043	0.0315
63	0.3	0.4	0.35	1.2	1.2	1.2	0.029	0.036	0.0325
64	0.4	0.6	0.5	0.7	0.7	0.7	0.023	0.019	0.021
65	0.3	0.4	0.35	1	1	1	0.027	0.048	0.0375
66	0.3	0.3	0.3	0.9	0.9	0.9	0.051	0.032	0.0415
67	0.2	0.2	0.2	1	1	1	0.026	0.036	0.031
68	0.2	0.1	0.15	1.1	1.1	1.1	0.042	0.036	0.039
69	0.2	1	0.6	1.2	1.2	1.2	0.054	0.071	0.0625
70	0.3	0.4	0.35	2.1	2.1	2.1	0.047	0.042	0.0445
71	0.2	0.2	0.2	1.7	1.7	1.7	0.02	0.026	0.023
72	0.7	0.7	0.7	1.4	1.4	1.4	0.036	0.006	0.021
73	0.3	0.3	0.3	1	1	1	0.038	0.002	0.02
74	0.4	0.4	0.4	1.3	1.3	1.3	0.033	0.033	0.033
75	0.2	0.2	0.2	1.4	1.4	1.4	0.016	0.016	0.016
76	0.8	0.8	0.8	1.3	1.3	1.3	0.027	0.027	0.027
77	0.4	0.4	0.4	1.4	1.4	1.4	0.056	0.056	0.056
78	0.2	0.2	0.2	1.3	1.3	1.3	0.064	0.064	0.064
79	0.6	0.6	0.6	0.8	0.8	0.8	0.03	0.03	0.03
80	0.3	0.3	0.3	0.7	0.7	0.7	0.023	0.023	0.023
81	0.3	0.3	0.3	0.6	0.6	0.6	0.015	0.015	0.015
82	0.7	0.7	0.7	0.8	0.8	0.8	0.003	0.003	0.003
83	0.4	0.4	0.4	0.5	0.5	0.5	0.001	0.001	0.001

Table: Set 1 data for channel two (input I) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
1	0.1	0.1	0.1	0.1	0.1	0.1	0.003	0.003	0.003
2	0.1	0.2	0.15	0.1	0.7	0.4	0.002	0.01	0.006
3	0.4	0.3	0.35	0.5	10.5	5.5	0.123	0.491	0.307
4	0.9	1.4	1.15	0.2	30.8	15.5	0.507	0.412	0.4595
5	1.3	1.2	1.25	3	8.8	5.9	0.433	0.574	0.5035
6	1.2	5.4	3.3	7.9	11.1	9.5	0.791	1.048	0.9195
7	1	2.3	1.65	6.2	27.5	16.85	0.566	0.928	0.747

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
8	1.4	2.4	1.9	5.8	18.4	12.1	0.52	0.899	0.7095
9	4.8	2.2	3.5	14.9	15.1	15	0.948	0.768	0.858
10	1.7	2.3	2	14.6	15.4	15	1.148	1.282	1.215
11	3.9	3.3	3.6	16.2	14.5	15.35	1.394	1.133	1.2635
12	4.4	2.1	3.25	14.5	19.5	17	1.31	0.755	1.0325
13	2.6	0.7	1.65	17	15	16	1.659	1.017	1.338
14	4.9	1.8	3.35	12.2	19.7	15.95	0.805	0.727	0.766
15	3.5	2	2.75	17.1	14.4	15.75	0.732	0.399	0.5655
16	3.6	1.4	2.5	18.5	6.8	12.65	0.653	0.637	0.645
17	2.6	3.9	3.25	13.6	7.6	10.6	0.535	0.896	0.7155
18	2.7	3.5	3.1	16	18.7	17.35	0.776	0.511	0.6435
19	3.6	5.1	4.35	32.4	14.7	23.55	0.846	1.549	1.1975
20	2.9	9.8	6.35	16.5	24	20.25	0.829	1.142	0.9855
21	3.4	12.1	7.75	17.5	15.5	16.5	1.012	0.803	0.9075
22	3	6.6	4.8	15.8	17.5	16.65	0.853	0.886	0.8695
23	3.1	12.2	7.65	16.5	26	21.25	0.978	0.556	0.767
24	3.1	5.8	4.45	32.9	27.6	30.25	0.723	1.148	0.9355
25	2.6	8.2	5.4	21.3	40.7	31	0.95	1.067	1.0085
26	3.4	4.3	3.85	28.8	28.2	28.5	0.579	0.646	0.6125
27	2.8	3.5	3.15	13.4	13.5	13.45	0.881	1.419	1.15
28	2.6	4	3.3	11.8	16.2	14	1.079	0.999	0.04
29	4.2	2.4	3.3	30.2	10.4	20.3	0.866	0.878	0.872
30	1.8	2.6	2.2	14.4	17.2	15.8	0.957	1.344	1.1505
31	2.7	2.7	2.7	15.6	17.3	16.45	0.704	9999	0.852
32	1.8	3.3	2.55	10.6	51.3	30.95	0.62	0.735	0.6775
33	3.4	3.8	3.6	9	39.4	24.2	0.61	1.09	0.85
34	1.9	3.1	2.5	26.2	15.4	20.8	0.366	0.687	0.5265
35	1.9	3.3	2.6	17.2	23.2	20.2	0.931	0.999	0.966
36	2.1	6.2	4.15	14	27.1	20.55	1.218	1.225	1.2215
37	1.3	6.3	3.8	21.8	32.8	27.3	0.358	0.829	0.5935
38	1.9	6.3	4.1	24.5	37.6	31.05	1.124	1.019	1.0715
39	1.8	7.4	4.6	32.1	14.5	23.3	0.761	0.489	0.625
40	2.3	3.6	2.95	17.9	22.3	20.1	0.624	0.749	0.6865
41	2.4	3	2.7	23.6	25.2	24.4	0.645	0.703	0.674
42	1.8	2	1.9	19.7	20.9	20.3	1.896	1.029	1.4625
43	1.2	2.5	1.85	19.5	22.6	21.05	1.282	0.999	0.141
44	2.3	2.8	2.55	20.9	25.6	23.25	0.999	1.012	0.006
45	4.6	3.1	3.85	35.6	34.6	35.1	0.733	0.657	0.695

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
46	3.4	2.7	3.05	27.7	29	28.35	1.737	1.312	1.5245
47	2.2	1.9	2.05	25.9	30.8	28.35	0.672	0.82	0.746
48	1.3	1.6	1.45	36.9	64.9	50.9	1.824	0.999	0.412
49	2.3	1.9	2.1	25.8	28.1	26.95	1.257	1.268	1.2625
50	1.9	1.5	1.7	30.6	13.3	21.95	1.074	1.805	1.4395
51	2.1	2	2.05	39.2	34.6	36.9	1.292	1.513	1.4025
52	2.3	2.1	2.2	18.2	16.1	17.15	0.739	0.999	0.87
53	1.4	2.2	1.8	23.6	12.3	17.95	0.666	1.676	1.171
54	3.2	2.1	2.65	20.5	8.3	14.4	1.455	1.6	1.5275
55	2.1	2.3	2.2	21	8.5	14.75	0.513	1.408	0.9605
56	1.2	2.7	1.95	26.6	7.7	17.15	1.327	1.271	1.299
57	1	1.3	1.15	14	1.5	7.75	1.437	1.429	1.433
58	0.7	1.7	1.2	13.1	0.5	6.8	0.786	1.947	1.3665
59	0.8	2.2	1.5	12.3	12.3	12.3	0.801	1.706	1.2535
60	1.4	1.6	1.5	21.2	21.2	21.2	0.81	1.348	1.079
61	2.1	2	2.05	11.2	11.2	11.2	1.138	9999	0.069
62	1.6	2.6	2.1	10.2	10.2	10.2	0.852	1.628	1.24
63	1.6	3	2.3	15.6	15.6	15.6	0.979	0.896	0.9375
64	1.7	2.3	2	17.4	17.4	17.4	1.03	0.552	0.791
65	2.3	2	2.15	11.7	11.7	11.7	0.999	0.999	0.999
66	2	2.2	2.1	13.5	13.5	13.5	1.655	1.444	1.5495
67	1.5	1.2	1.35	69.6	69.6	69.6	1.474	9999	0.237
68	1.5	0.2	0.85	18.5	18.5	18.5	1.759	1.615	1.687
69	1.5	0.1	0.8	27.3	27.3	27.3	0.999	0.999	0.999
70	1.5	0.1	0.8	28.5	28.5	28.5	1.617	1.808	1.7125
71	0.9	0.9	0.9	34.6	34.6	34.6	0.918	0.788	0.853
72	1.5	1.5	1.5	22.6	22.6	22.6	1.883	0.084	0.9835
73	1.1	1.1	1.1	22.2	22.2	22.2	0.999	0.049	0.525
74	1.2	1.2	1.2	42.1	42.1	42.1	0.999	0.999	9999
75	1.5	1.5	1.5	43.7	43.7	43.7	0.823	0.823	0.823
76	0.6	0.6	0.6	25.7	25.7	25.7	0.449	0.449	0.449
77	1	1	1	16.1	16.1	16.1	1.348	1.348	1.348
78	1.6	1.6	1.6	46.3	46.3	46.3	0.999	0.999	0.999
79	1.8	1.8	1.8	22.4	22.4	22.4	1.689	1.689	1.689
80	1.7	1.7	1.7	21.2	21.2	21.2	0.686	0.686	0.686
81	1.3	1.3	1.3	17.6	17.6	17.6	0.641	0.641	0.641
82	2.5	2.5	2.5	23.2	23.2	23.2	0.186	0.186	0.186
83	2.5	2.5	2.5	20.7	20.7	20.7	0.051	0.051	0.051

Table: Set 1 data for channel three (input II) modified model

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
1	0.1	0.2	0.15	0.2	0.1	0.15	0.008	0.012	0.01
2	0.1	0.2	0.15	0.3	0.8	0.55	0.008	0.016	0.012
3	0.2	0.4	0.3	0.4	12.7	6.55	0.162	0.46	0.311
4	0.8	1.4	1.1	0.2	21.6	10.9	0.663	0.553	0.608
5	1.2	1.6	1.4	1.3	10.5	5.9	0.619	0.95	0.7845
6	1.6	4.5	3.05	6.6	13	9.8	0.617	0.823	0.72
7	1.4	3.6	2.5	9.3	19.9	14.6	0.472	1.567	1.0195
8	1.8	3.2	2.5	6.8	31.7	19.25	0.456	0.959	0.7075
9	10.5	2.6	6.55	20	10.3	15.15	1.532	1.104	1.318
10	2	3.6	2.8	13.2	15.4	14.3	1.552	0.99	1.271
11	3.2	3.7	3.45	14.2	17.6	15.9	1.565	1.059	1.312
12	3.3	2.4	2.85	16.1	16.9	16.5	1.454	0.859	1.1565
13	2.2	0.9	1.55	22.6	15.1	18.85	1.748	1.553	1.6505
14	8.3	8.4	8.35	10.6	20.3	15.45	1.161	0.975	1.068
15	4.8	2.3	3.55	13.9	16	14.95	0.701	0.533	0.617
16	4.8	1.9	3.35	14.2	11.5	12.85	0.868	0.62	0.744
17	3.6	2.8	3.2	8.6	6	7.3	0.755	0.965	0.86
18	3.2	3.5	3.35	16.6	18.3	17.45	0.952	0.765	0.8585
19	2.6	15	8.8	30.1	20.5	25.3	0.975	1.261	1.118
20	3.3	8.6	5.95	16.6	44.9	30.75	0.861	1.079	0.97
21	2.9	9.9	6.4	15.5	20.9	18.2	0.919	0.748	0.8335
22	4	12.6	8.3	9.2	25.6	17.4	0.76	0.752	0.756
23	3.2	9	6.1	20.2	43.3	31.75	0.918	0.513	0.7155
24	2.7	9.2	5.95	24.1	32.2	28.15	1.026	1.175	1.1005
25	2.6	7.7	5.15	17.3	37.4	27.35	1.06	0.663	0.8615
26	3.9	10.8	7.35	24.6	26.5	25.55	1.086	0.663	0.8745
27	2.8	4.5	3.65	23.1	18.2	20.65	0.647	1.649	1.148
28	3.6	5	4.3	13.9	12.9	13.4	1.239	1.677	1.458
29	4.4	3.6	4	16	19.9	17.95	0.972	0.639	0.8055
30	1.9	2.3	2.1	13	12.7	12.85	1.301	1.405	1.353
31	2.9	2.8	2.85	17.8	19.9	18.85	0.865	0.999	0.933
32	2.8	3.1	2.95	11.6	60.5	36.05	1.039	0.758	0.8985
33	3.2	2.6	2.9	36.6	30.3	33.45	0.582	1.512	1.047
34	1.7	3.9	2.8	28.5	18.4	23.45	0.492	0.785	0.6385
35	2.6	3	2.8	18	17.9	17.95	1.033	1.691	1.362

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
36	2.4	4.9	3.65	18.5	20.3	19.4	1.293	1.606	1.4495
37	1.3	5.4	3.35	25.7	27.8	26.75	0.438	0.83	0.634
38	1.9	8.9	5.4	18.7	37.5	28.1	1.171	0.911	1.041
39	1.8	6.9	4.35	18.6	19.7	19.15	0.816	0.68	0.748
40	2.1	5.5	3.8	16.7	22.3	19.5	0.822	0.722	0.772
41	2.1	2.6	2.35	19.6	17.9	18.75	0.587	0.999	0.794
42	2.1	1.8	1.95	22.1	46.5	34.3	0.999	1.388	0.194
43	2.4	2.7	2.55	22	32.5	27.25	1.311	0.999	0.156
44	2.3	2.9	2.6	25.8	35.1	30.45	0.908	1.406	1.157
45	3.2	3.4	3.3	15	29.2	22.1	0.742	0.74	0.741
46	4	2.2	3.1	16.8	13.3	15.05	1.622	1.067	1.3445
47	3	1.8	2.4	26.8	25.4	26.1	0.692	0.906	0.799
48	1.5	1.7	1.6	23	23.2	23.1	0.999	0.999	0.999
49	2.1	1.9	2	22.9	16.9	19.9	0.912	1.475	1.1935
50	2.5	1.5	2	30.7	17.8	24.25	1.221	1.933	1.577
51	2.9	2.5	2.7	25.2	79.6	52.4	1.284	1.17	1.227
52	3.3	2.6	2.95	19.3	10.6	14.95	1.117	0.999	0.059
53	2	2	2	16.2	13.3	14.75	0.788	1.695	1.2415
54	2.9	2.2	2.55	15.1	11.9	13.5	1.845	1.759	1.802
55	1.7	2.2	1.95	19.5	8.1	13.8	0.689	1.25	0.9695
56	1.5	2.5	2	33.8	5.2	19.5	1.398	1.317	1.3575
57	1	1.6	1.3	15	3	9	1.391	1.602	1.4965
58	0.8	1.5	1.15	12.7	0.8	6.75	0.828	0.999	0.914
59	0.8	2.2	1.5	19.3	19.3	19.3	1.174	1.764	1.469
60	1.7	1.7	1.7	17.3	17.3	17.3	1.02	1.651	1.3355
61	1.8	1.7	1.75	13.2	13.2	13.2	0.928	0.999	0.964
62	1.8	2.3	2.05	14.4	14.4	14.4	0.675	1.991	1.333
63	2	2.5	2.25	14.1	14.1	14.1	1.116	1.299	1.2075
64	2.5	2.4	2.45	15.4	15.4	15.4	0.88	0.661	0.7705
65	1.8	2.4	2.1	9.9	9.9	9.9	1.058	1.891	1.4745
66	1.7	3.6	2.65	13.1	13.1	13.1	1.973	1.395	1.684
67	1.5	1.9	1.7	28.9	28.9	28.9	1.443	1.823	1.633
68	1.6	2.4	2	10.3	10.3	10.3	1.649	1.221	1.435
69	1.9	0.6	1.25	26.2	26.2	26.2	1.625	0.999	0.313
70	1.4	0.7	1.05	19.9	19.9	19.9	1.508	1.445	1.4765
71	1.2	1.2	1.2	20.7	20.7	20.7	1.271	1.673	1.472
72	1.7	1.7	1.7	36.5	36.5	36.5	1.735	0.144	0.9395
73	1.5	1.5	1.5	23.4	23.4	23.4	1.734	0.114	0.924

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
74	2	2	2	90	90	90	1.264	1.264	1.264
75	1.5	1.5	1.5	35.7	35.7	35.7	0.773	0.773	0.773
76	0.8	0.8	0.8	38.7	38.7	38.7	0.959	0.959	0.959
77	1.1	1.1	1.1	16.8	16.8	16.8	1.346	1.346	1.346
78	1.2	1.2	1.2	25	25	25	1.87	1.87	1.87
79	1.7	1.7	1.7	22.5	22.5	22.5	1.132	1.132	1.132
80	2.2	2.2	2.2	27.6	27.6	27.6	0.732	0.732	0.732
81	2.1	2.1	2.1	34.9	34.9	34.9	0.665	0.665	0.665
82	3.1	3.1	3.1	34.6	34.6	34.6	0.338	0.338	0.338
83	3.8	3.8	3.8	21.3	21.3	21.3	0.041	0.041	0.041

Table: Set 2 data for channel one (output) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
1	0.2	0.1	0.15	0.1	0.1	0.1	0.001	0.001	0.001
2	0.1	0.1	0.1	0.1	0.2	0.15	0.001	0.002	0.0015
3	0.1	0.1	0.1	0.2	0.5	0.35	0.009	0.02	0.0145
4	0.3	0.3	0.3	0.6	0.7	0.65	0.02	0.011	0.0155
5	0.3	0.2	0.25	0.4	0.8	0.6	0.012	0.023	0.0175
6	0.2	0.1	0.15	0.6	0.6	0.6	0.021	0.04	0.0305
7	0.1	0.3	0.2	0.7	0.8	0.75	0.035	0.03	0.0325
8	0.3	0.5	0.4	0.8	0.8	0.8	0.031	0.029	0.03
9	0.2	0.3	0.25	0.7	0.8	0.75	0.023	0.031	0.027
10	0.3	0.5	0.4	0.8	0.6	0.7	0.016	0.039	0.0275
11	0.4	0.7	0.55	0.5	0.7	0.6	0.036	0.031	0.0335
12	0.2	1.1	0.65	0.8	0.8	0.8	0.024	0.061	0.0425
13	0.2	0.4	0.3	0.7	0.7	0.7	0.033	0.02	0.0265
14	0.6	0.2	0.4	1.1	0.8	0.95	0.043	0.029	0.036
15	0.4	0.4	0.4	1.2	0.8	1	0.029	0.041	0.035
16	0.4	0.5	0.45	0.8	0.7	0.75	0.02	0.018	0.019
17	0.2	0.9	0.55	0.7	1.8	1.25	0.017	0.034	0.0255
18	0.2	0.4	0.3	0.8	0.6	0.7	0.016	0.025	0.0205
19	0.2	0.3	0.25	0.7	0.7	0.7	0.018	0.012	0.015
20	0.5	0.4	0.45	0.8	0.7	0.75	0.057	0.03	0.0435
21	0.7	0.4	0.55	0.7	0.5	0.6	0.024	0.021	0.0225

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
22	0.7	1.4	1.05	0.6	1.2	0.9	0.022	0.012	0.017
23	0.5	1	0.75	1	1.5	1.25	0.038	0.07	0.054
24	0.3	0.8	0.55	1.1	1.5	1.3	0.043	0.051	0.047
25	0.3	0.8	0.55	1.5	0.9	1.2	0.025	0.034	0.0295
26	0.5	1.2	0.85	1	0.8	0.9	0.026	0.031	0.0285
27	0.3	1.7	1	0.8	0.8	0.8	0.033	0.025	0.029
28	0.4	0.7	0.55	0.8	0.7	0.75	0.031	0.043	0.037
29	0.8	1.1	0.95	0.8	1.8	1.3	0.039	0.032	0.0355
30	0.5	1.2	0.85	1	0.8	0.9	0.021	0.036	0.0285
31	0.7	0.6	0.65	0.8	1	0.9	0.018	0.016	0.017
32	0.3	0.8	0.55	0.9	1	0.95	0.041	0.027	0.034
33	0.4	1.2	0.8	1	1	1	0.032	0.021	0.0265
34	0.6	0.8	0.7	0.8	1.2	1	0.022	0.025	0.0235
35	0.6	0.5	0.55	0.8	0.8	0.8	0.023	0.026	0.0245
36	0.4	0.4	0.4	1	0.7	0.85	0.046	0.086	0.066
37	0.3	0.3	0.3	1	1.1	1.05	0.019	0.019	0.019
38	0.5	0.4	0.45	1.2	0.7	0.95	0.023	0.028	0.0255
39	0.5	0.6	0.55	0.8	0.8	0.8	0.017	0.027	0.022
40	0.3	0.3	0.3	1	0.6	0.8	0.045	0.021	0.033
41	0.3	0.3	0.3	0.7	1.2	0.95	0.03	0.036	0.033
42	0.3	0.2	0.25	0.8	1.1	0.95	0.031	0.026	0.0285
43	0.3	0.2	0.25	0.8	1.3	1.05	0.04	0.028	0.034
44	0.2	0.3	0.25	0.8	0.7	0.75	0.053	0.037	0.045
45	0.2	0.2	0.2	0.7	0.9	0.8	0.059	0.047	0.053
46	0.2	0.3	0.25	0.6	0.7	0.65	0.033	0.061	0.047
47	0.2	0.4	0.3	0.6	0.6	0.6	0.052	0.089	0.0705
48	0.4	0.4	0.4	0.5	0.8	0.65	0.033	0.025	0.029
49	0.3	0.4	0.35	0.3	0.6	0.45	0.031	0.048	0.0395
50	0.2	0.6	0.4	0.4	0.7	0.55	0.034	0.018	0.026
51	0.3	0.4	0.35	0.4	0.7	0.55	0.031	0.038	0.0345
52	0.5	0.3	0.4	0.7	0.7	0.7	0.023	0.043	0.033
53	0.3	0.3	0.3	0.6	0.6	0.6	0.045	0.045	0.045
54	0.3	0.4	0.35	0.8	0.6	0.7	0.066	0.029	0.0475
55	0.5	0.4	0.45	0.9	0.6	0.75	0.043	0.019	0.031
56	0.3	0.4	0.35	0.6	0.5	0.55	0.057	0.023	0.04
57	0.2	0.3	0.25	0.7	0.4	0.55	0.024	0.039	0.0315
58	0.2	0.3	0.25	0.6	1	0.8	0.042	0.042	0.042
59	0.1	0.2	0.15	0.8	0.6	0.7	0.084	0.049	0.0665

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1
60	0.2	0.2	0.2	1	0.7	0.85	0.059	0.052	0.0555
61	0.2	0.2	0.2	0.7	0.4	0.55	0.073	0.033	0.053
62	0.2	0.2	0.2	0.5	0.7	0.6	0.025	0.065	0.045
63	0.1	0.3	0.2	0.5	0.5	0.5	0.039	0.039	0.039
64	0.1	0.2	0.15	0.7	0.5	0.6	0.026	0.103	0.0645
65	0.2	0.2	0.2	0.6	0.4	0.5	0.029	0.081	0.055
66	0.2	0.3	0.25	0.5	0.4	0.45	0.036	0.082	0.059
67	0.2	0.2	0.2	0.6	0.4	0.5	0.068	0.068	0.068
68	0.2	0.3	0.25	1	0.5	0.75	0.055	0.062	0.0585
69	0.2	0.3	0.25	0.4	1.1	0.75	0.036	0.04	0.038
70	0.2	0.3	0.25	0.6	0.6	0.6	0.033	0.013	0.023
71	0.2	0.3	0.25	0.9	0.9	0.9	0.056	0.056	0.056
72	0.2	0.3	0.25	0.7	0.7	0.7	0.019	0.019	0.019
73	0.2	0.4	0.3	0.8	0.8	0.8	0.003	0.003	0.003
74	0.3	0.3	0.3	0.7	0.7	0.7	0.001	0.001	0.001

Table: Set 2 data for channel two (input I) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
1	0.1	0	0.05	0.2	0.1	0.15	0.016	0.021	0.0185
2	0.1	0	0.05	0.7	11.6	6.15	0.029	0.083	0.056
3	0	1	0.5	5.4	13.7	9.55	0.437	0.655	0.546
4	0	1	0.5	8.8	12.7	10.75	1.251	0.417	0.834
5	0	1.2	0.6	22.2	22.3	22.25	0.677	1.511	1.094
6	1.6	1.6	1.6	11.7	13.2	12.45	0.919	0.999	0.96
7	0.8	4.2	2.5	19	34	26.5	1.79	1.401	1.5955
8	0.6	3.1	1.85	21.4	33.6	27.5	1.247	1.322	1.2845
9	1.2	2.2	1.7	13.6	27.5	20.55	1.273	1.42	1.3465
10	1.5	2.5	2	20.8	12.5	16.65	1.097	0.999	0.049
11	1.6	4.6	3.1	30.9	31.6	31.25	1.322	1.989	1.6555
12	1.8	3.9	2.85	19.6	20.5	20.05	1.532	1.856	1.694
13	1.6	1.4	1.5	32.3	22.5	27.4	1.616	1.314	1.465
14	3.5	1.2	2.35	53.3	16.6	34.95	0.999	1.137	0.069
15	2.3	1.4	1.85	31.3	31.1	31.2	1.294	1.171	1.2325
16	4.6	2	3.3	22.3	22.9	22.6	0.948	0.552	0.75

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
17	1.9	3.7	2.8	13.7	53	33.35	0.554	1.444	0.999
18	1.9	1.6	1.75	16.1	40.6	28.35	0.501	0.926	0.7135
19	2	2.7	2.35	37.5	28.4	32.95	0.725	0.261	0.493
20	3.1	2.6	2.85	23.4	9.9	16.65	1.008	0.699	0.8535
21	1.8	2.9	2.35	18	15.3	16.65	1.704	0.763	1.2335
22	1.5	4.9	3.2	14.8	70.7	42.75	1.031	0.653	0.842
23	2.3	4.3	3.3	34.4	49	41.7	0.852	0.992	0.922
24	1.4	5.9	3.65	55.4	55.8	55.6	0.894	1.061	0.9775
25	2.3	3.9	3.1	35.8	23.7	29.75	1.35	1.049	1.1995
26	1.8	5.8	3.8	27	28.5	27.75	0.958	0.605	0.7815
27	4.5	6.8	5.65	32.3	27.1	29.7	1.21	0.569	0.8895
28	3.7	3.9	3.8	29.1	27.5	28.3	1.168	0.968	1.068
29	3.8	5.6	4.7	35.3	32	33.65	0.788	1.1	0.944
30	2.4	5.1	3.75	28.8	20.2	24.5	0.556	0.852	0.704
31	3	3.2	3.1	24.4	25.5	24.95	0.904	0.676	0.79
32	3.7	5.7	4.7	17.3	21.8	19.55	1.364	0.756	1.06
33	3.8	4.6	4.2	37	17.7	27.35	0.81	1.237	1.0235
34	3.9	7.1	5.5	24.4	26	25.2	0.763	0.695	0.729
35	3.1	2.7	2.9	28.8	32	30.4	0.698	0.946	0.822
36	2.9	2.7	2.8	29.2	21.6	25.4	1.059	0.784	0.9215
37	4.3	3	3.65	34.5	32.9	33.7	0.595	0.582	0.5885
38	3.4	2.4	2.9	44.8	15.6	30.2	0.901	0.839	0.87
39	6.8	2.4	4.6	23	24.3	23.65	0.733	0.74	0.7365
40	2.9	1.8	2.35	28.2	11.2	19.7	1.475	0.657	1.066
41	3.5	1.4	2.45	18.3	19.1	18.7	0.839	0.912	0.8755
42	2.5	1.2	1.85	13.4	23.9	18.65	0.696	0.973	0.8345
43	2.1	1.2	1.65	42.1	57	49.55	0.999	0.752	0.876
44	2.5	1.3	1.9	16.5	23.8	20.15	1.02	1.306	1.163
45	1.6	2	1.8	38.3	19.6	28.95	1.319	1.034	1.1765
46	2.4	2.1	2.25	22.4	23.7	23.05	1.325	1.682	1.5035
47	2.1	1.9	2	17.4	17.1	17.25	1.162	0.999	0.081
48	2	3.8	2.9	33.3	24	28.65	0.812	0.717	0.7645
49	1.5	3.4	2.45	8	23.6	15.8	0.981	0.962	0.9715
50	1.6	1.7	1.65	8.9	17.6	13.25	1.191	1.356	1.2735
51	2.6	2.9	2.75	10	25.1	17.55	1.066	1.282	1.174
52	2.5	2.1	2.3	19	14.6	16.8	0.884	1.174	1.029
53	1.4	1.7	1.55	19.2	12.4	15.8	1.295	0.785	1.04
54	2.1	1.7	1.9	18.4	12.6	15.5	1.153	0.879	1.016

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2
55	2	3.1	2.55	35.8	24.2	30	1.152	0.731	0.9415
56	2.5	1.8	2.15	20.3	9.3	14.8	0.999	0.737	0.869
57	6	1.5	3.75	35.1	20.4	27.75	0.734	0.752	0.743
58	2.4	2.4	2.4	23.6	15.8	19.7	1.605	0.922	1.2635
59	2.7	1.7	2.2	42.2	16.6	29.4	0.999	1.098	0.049
60	2.3	1.6	1.95	28.8	12.5	20.65	1.53	0.829	1.1795
61	2.6	1.2	1.9	25.4	11.4	18.4	0.999	1.544	0.272
62	3.5	1.2	2.35	24.7	13.1	18.9	1.125	0.886	1.0055
63	2.3	1.9	2.1	24.4	13.9	19.15	1.286	0.994	1.14
64	1.9	2.2	2.05	31.1	11.8	21.45	1.255	0.999	0.128
65	1.2	2.1	1.65	14.9	6.6	10.75	0.97	0.999	0.985
66	1.8	2	1.9	10.6	9	9.8	0.999	0.999	0.999
67	1.6	2.2	1.9	13.6	12.4	13	1.836	1.508	1.672
68	1.2	2.6	1.9	21.1	17.9	19.5	0.999	1.992	0.496
69	1.1	2.1	1.6	1.8	20.6	11.2	1.456	1.595	1.5255
70	1.1	2.4	1.75	10.9	10.9	10.9	1.225	0.722	0.9735
71	1.4	2	1.7	39.1	39.1	39.1	1.637	1.637	1.637
72	1.5	2.6	2.05	13.5	13.5	13.5	1.1	1.1	1.1
73	1.6	2	1.8	21.8	21.8	21.8	0.082	0.082	0.082
74	2.6	3.7	3.15	15.9	15.9	15.9	0.013	0.013	0.013

Table: Set 2 data for channel three (input II) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
1	0.2	0	0.1	0.2	0.1	0.15	0.032	0.037	0.0345
2	0.1	0.1	0.1	1	16.1	8.55	0.045	0.075	0.06
3	0.1	1.3	0.7	5.5	12.8	9.15	0.256	0.679	0.4675
4	0.1	1	0.55	12	14.8	13.4	0.677	0.447	0.562
5	0	1.3	0.65	18.1	25.8	21.95	0.598	1.051	0.8245
6	1.7	1.4	1.55	17.4	15.6	16.5	0.989	1.596	1.2925
7	1	4.4	2.7	30.1	24.6	27.35	1.403	1.354	1.3785
8	0.8	3.3	2.05	37.3	21.2	29.25	1.36	1.551	1.4555
9	1.4	2.8	2.1	20.3	22.2	21.25	1.426	1.367	1.3965
10	2.3	3.4	2.85	24.2	16.3	20.25	0.835	0.999	0.918
11	2.1	4.1	3.1	17.1	20.4	18.75	1.517	1.912	1.7145
12	2.8	4.6	3.7	18.4	25.5	21.95	1.202	0.999	0.101

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
13	1.9	1.3	1.6	16.3	34.2	25.25	1.138	1.827	1.4825
14	3.2	2.3	2.75	41.5	34.8	38.15	1.87	1.444	1.657
15	3	1.2	2.1	56.5	21.8	39.15	1.305	1.639	1.472
16	3.9	2.2	3.05	21.4	33.2	27.3	0.733	0.602	0.6675
17	1.8	4.4	3.1	24	42.4	33.2	0.667	1.701	1.184
18	2.1	1.8	1.95	18	27.1	22.55	0.519	0.689	0.604
19	2.1	2.6	2.35	37.8	14.9	26.35	0.832	0.439	0.6355
20	6.4	2.8	4.6	32.3	24.9	28.6	1.342	0.944	1.143
21	2.4	2.2	2.3	29.6	15.9	22.75	0.886	0.788	0.837
22	1.9	9.8	5.85	16.9	69.6	43.25	0.917	0.793	0.855
23	2.3	4.5	3.4	29.5	45.6	37.55	1.147	0.999	0.074
24	1.4	5	3.2	65.6	46.3	55.95	0.985	1.319	1.152
25	3.3	3	3.15	38	31	34.5	1.87	0.621	1.2455
26	2.3	4.3	3.3	29.1	21	25.05	0.848	0.803	0.8255
27	6	7.8	6.9	29.7	24.1	26.9	1.309	0.946	1.1275
28	4.5	3.3	3.9	46.1	16.4	31.25	0.81	0.945	0.8775
29	2.9	6.7	4.8	23.3	36.6	29.95	0.891	1.408	1.1495
30	2.7	3.9	3.3	21	17.5	19.25	0.969	0.89	0.9295
31	2.4	3.1	2.75	24.9	32.5	28.7	0.813	0.75	0.7815
32	3.1	5.4	4.25	32.1	36.8	34.45	1.117	0.939	1.028
33	3.6	4.2	3.9	40.3	33.4	36.85	0.795	0.744	0.7695
34	2.5	7.5	5	25	28.3	26.65	0.585	0.673	0.629
35	3.1	3.3	3.2	23.5	45.5	34.5	0.856	0.926	0.891
36	2.6	2.2	2.4	52	68.6	60.3	1.04	0.999	0.02
37	4.1	2.6	3.35	39.1	24.9	32	0.676	0.632	0.654
38	2.7	3.1	2.9	20.5	11.5	16	0.68	0.801	0.7405
39	7.7	2.6	5.15	23.8	30.2	27	0.689	0.52	0.6045
40	4.2	2	3.1	23.2	13.8	18.5	1.101	0.758	0.9295
41	3.9	1.6	2.75	28.7	75.5	52.1	1.022	0.758	0.89
42	2.6	1.2	1.9	14.5	25	19.75	0.872	0.728	0.8
43	1.7	1.4	1.55	42.7	33.6	38.15	1.081	1.127	1.104
44	3	1.4	2.2	28.2	24.8	26.5	1.53	1.317	1.4235
45	2.3	1.6	1.95	19.5	22.3	20.9	1.484	0.855	1.1695
46	4	2.7	3.35	11.9	22.5	17.2	1.17	1.381	1.2755
47	2.8	2.1	2.45	17.1	20.7	18.9	1.348	0.999	0.174
48	2.7	5	3.85	20.9	19	19.95	0.88	0.882	0.881
49	2.2	4	3.1	7.6	24.3	15.95	0.744	1.193	0.9685
50	1.8	1.9	1.85	10.9	19.2	15.05	0.969	0.719	0.844

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)		
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3
51	3.3	4	3.65	16.4	23.5	19.95	0.866	1.741	1.3035
52	2	2.2	2.1	35.4	21.7	28.55	0.656	1.202	0.929
53	1.8	2.4	2.1	13.3	29.4	21.35	1.113	0.716	0.9145
54	3	2	2.5	22.4	16.6	19.5	1.006	1.148	1.077
55	2.5	3.3	2.9	28	24.6	26.3	0.936	0.564	0.75
56	2.2	2.1	2.15	17.1	13.3	15.2	0.742	0.722	0.732
57	5.8	1.6	3.7	29.4	15.7	22.55	0.595	0.679	0.637
58	2.1	2	2.05	16.8	15.6	16.2	0.999	0.489	0.745
59	3.7	1.4	2.55	26.4	17	21.7	0.999	0.785	0.893
60	2.7	1.5	2.1	38.4	19.4	28.9	1.793	1.361	1.577
61	3.2	1.2	2.2	20.6	9	14.8	0.999	1.991	0.496
62	2.6	1.1	1.85	28.1	22.5	25.3	0.863	1.884	1.3735
63	2	1.8	1.9	12.7	12.2	12.45	1.834	0.756	1.295
64	2	2.2	2.1	45.6	15.6	30.6	1.817	0.999	0.409
65	2	1.6	1.8	20.5	12.3	16.4	1.453	1.86	1.6565
66	2	1.9	1.95	11	9.7	10.35	0.999	1.508	0.254
67	2.6	2.3	2.45	19.2	12.8	16	0.999	1.26	0.13
68	1.5	2.4	1.95	39.6	26.8	33.2	0.999	1.814	0.407
69	1.2	2.5	1.85	1.4	51.8	26.6	1.692	1.744	1.718
70	1.2	2.5	1.85	13.4	13.4	13.4	1.473	0.727	1.1
71	1.9	2.6	2.25	32.3	32.3	32.3	1.504	1.504	1.504
72	1.6	2.2	1.9	19.8	19.8	19.8	1.141	1.141	1.141
73	1.8	2.4	2.1	21.1	21.1	21.1	0.061	0.061	0.061
74	2	2.6	2.3	17.8	17.8	17.8	0.03	0.03	0.03

Table: Set 3 data for channel one (output) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	CH1	Avg of CH1
1	0.1	0.2	0.15	0.1	0.1	0.1	0.001	0.001	0	0.000667
2	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.002	0.001	0.001333
3	0.1	0.4	0.25	0.1	0.6	0.35	0.001	0.025	0.019	0.015
4	1.1	0.3	0.7	0.3	0.5	0.4	0.008	0.007	0.013	0.009333
5	0.3	0.2	0.25	0.2	0.7	0.45	0.013	0.018	0.025	0.018667
6	0.3	0.2	0.25	0.5	1.4	0.95	0.019	0.024	0.022	0.021667
7	0.2	0.4	0.3	0.5	0.8	0.65	0.046	0.038	0.066	0.05
8	0.2	0.5	0.35	1	1.3	1.15	0.082	0.042	0.086	0.07

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	CH1	Avg of CH1
9	0.2	0.5	0.35	1.4	1.2	1.3	0.072	0.062	0.08	0.071333
10	0.2	0.3	0.25	1.5	0.8	1.15	0.118	0.035	0.04	0.064333
11	0.7	0.8	0.75	1	0.6	0.8	0.129	0.04	0.051	0.073333
12	0.5	0.5	0.5	1.3	0.9	1.1	0.063	0.03	0.111	0.068
13	1.4	0.6	1	0.8	1.1	0.95	0.045	0.054	0.073	0.057333
14	0.4	0.5	0.45	0.9	1.7	1.3	0.024	0.023	0.075	0.040667
15	0.4	1.1	0.75	0.7	1.8	1.25	0.02	0.02	0.051	0.030333
16	0.5	0.6	0.55	2.3	0.8	1.55	0.03	0.02	0.048	0.032667
17	0.3	0.4	0.35	3.7	1.2	2.45	0.035	0.02	0.069	0.041333
18	0.5	1.5	1	1.2	0.9	1.05	0.03	0.018	0.107	0.051667
19	0.6	1.7	1.15	1.4	1.6	1.5	0.051	0.066	0.09	0.069
20	1.5	1.1	1.3	1	1.2	1.1	0.044	0.028	0.063	0.045
21	0.8	0.7	0.75	1	1.4	1.2	0.04	0.016	0.032	0.029333
22	0.5	0.6	0.55	1.3	1.4	1.35	0.034	0.027	0.031	0.030667
23	0.3	1	0.65	0.8	1.7	1.25	0.048	0.024	0.031	0.034333
24	0.3	0.9	0.6	1.7	1.4	1.55	0.053	0.023	0.019	0.031667
25	0.4	1.1	0.75	1	0.9	0.95	0.06	0.047	0.022	0.043
26	0.4	2.1	1.25	0.8	0.8	0.8	0.03	0.039	0.016	0.028333
27	0.9	1.4	1.15	1.2	1	1.1	0.084	0.026	0.011	0.040333
28	1.2	0.8	1	1.3	1	1.15	0.107	0.031	0.01	0.049333
29	0.5	1	0.75	1.2	1	1.1	0.04	0.021	0.01	0.023667
30	0.6	1	0.8	1.2	1.2	1.2	0.023	0.038	0.027	0.029333
31	0.7	0.7	0.7	1.6	0.8	1.2	0.049	0.02	0.029	0.032667
32	0.6	0.7	0.65	0.8	1.3	1.05	0.046	0.023	0.031	0.033333
33	0.4	0.4	0.4	1	0.8	0.9	0.038	0.02	0.036	0.031333
34	0.3	0.4	0.35	1.4	0.7	1.05	0.032	0.022	0.039	0.031
35	0.2	0.5	0.35	1.1	0.8	0.95	0.023	0.027	0.046	0.032
36	0.2	0.5	0.35	0.8	0.8	0.8	0.015	0.027	0.046	0.029333
37	0.4	0.3	0.35	0.9	1	0.95	0.021	0.029	0.03	0.026667
38	0.3	0.3	0.3	0.6	1.4	1	0.016	0.043	0.029	0.029333
39	0.3	0.5	0.4	0.8	1.1	0.95	0.043	0.021	0.038	0.034
40	0.3	0.3	0.3	0.8	1	0.9	0.025	0.032	0.041	0.032667
41	0.4	0.4	0.4	1.2	1	1.1	0.024	0.026	0.027	0.025667
42	0.2	0.6	0.4	0.5	1.2	0.85	0.056	0.021	0.022	0.033
43	0.2	0.3	0.25	0.8	1.5	1.15	0.029	0.026	0.033	0.029333
44	0.2	0.3	0.25	0.6	1	0.8	0.021	0.03	0.033	0.028
45	0.2	0.4	0.3	0.9	0.8	0.85	0.024	0.066	0.032	0.040667
46	0.3	0.7	0.5	0.6	1.2	0.9	0.07	0.029	0.071	0.056667

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH1	CH1	Avg of CH1	CH1	CH1	Avg of CH1	CH1	CH1	CH1	Avg of CH1
47	0.2	0.3	0.25	1.2	0.9	1.05	0.107	0.04	0.036	0.061
48	0.2	0.3	0.25	1.3	1	1.15	0.061	0.022	0.032	0.038333
49	0.2	0.4	0.3	0.9	1.2	1.05	0.034	0.02	0.026	0.026667
50	0.3	0.4	0.35	1.2	0.8	1	0.032	0.048	0.034	0.038
51	0.6	0.4	0.5	0.7	0.8	0.75	0.062	0.043	0.029	0.044667
52	0.6	0.5	0.55	0.8	0.8	0.8	0.066	0.021	0.024	0.037
53	0.5	0.3	0.4	0.9	1.1	1	0.023	0.029	0.012	0.021333
54	0.6	0.3	0.45	0.9	0.9	0.9	0.04	0.033	0.029	0.034
55	0.7	0.3	0.5	1	1.1	1.05	0.074	0.048	0.015	0.045667
56	0.7	0.3	0.5	0.5	1.7	1.1	0.071	0.018	0.019	0.036
57	0.3	0.4	0.35	0.3	1.2	0.75	0.07	0.031	0.02	0.040333
58	0.4	0.4	0.4	0.1	1.1	0.6	0.053	0.021	0.024	0.032667
59	0.3	0.8	0.55	1.1	1.1	1.1	0.044	0.021	0.027	0.030667
60	0.3	0.3	0.3	1.4	1.4	1.4	0.064	0.057	0.03	0.050333
61	0.3	0.3	0.3	0.7	0.7	0.7	0.032	0.087	0.023	0.047333
62	0.4	0.5	0.45	0.7	0.7	0.7	0.004	0.041	0.051	0.032
63	0.3	0.3	0.3	1.1	1.1	1.1	0.002	0.053	0.041	0.032
64	0.4	0.3	0.35	0.4	0.4	0.4	0.001	0.038	0.037	0.025333
65	0.5	0.2	0.35	0.2	0.2	0.2	0.029	0.024	0.034	0.029

Table: Set 3 data for channel two (input I) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	CH2	Avg of CH2
1	0.2	0.3	0.25	0.1	0.1	0.1	0.011	0.003	0.003	0.006
2	0.1	0.2	0.15	0.1	1.3	0.7	0.015	0.044	0.007	0.022
3	1.4	1.2	1.3	0.6	13.4	7	0.005	0.894	0.656	0.518
4	1.9	1	1.45	6.3	11.7	9	0.259	0.294	0.925	0.493
5	2.6	1.5	2.05	2.1	23.6	12.85	0.791	0.879	1.412	1.027
6	2.6	4.4	3.5	5.1	13.3	9.2	0.63	1.566	1.326	1.174
7	2.2	3.3	2.75	11.7	16.7	14.2	1.194	1.718	0.900	0.971
8	1.8	3	2.4	41.7	17.3	29.5	1.623	0.999	0.900	0.541
9	2.5	2.7	2.6	28.1	39.9	34	0.999	0.999	0.900	0.995
10	3.2	3	3.1	15.2	15.8	15.5	1.928	1.718	1.421	1.689
11	6.7	3.7	5.2	23.8	20.9	22.35	0.999	0.999	1.946	0.649
12	1.7	2.2	1.95	32.5	18.9	25.7	1.57	1.089	0.900	0.886
13	9.4	2.4	5.9	15.6	32.7	24.15	1.275	0.999	0.900	0.425

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	CH2	Avg of CH2
14	1.6	2.7	2.15	15	49	32	0.619	1.171	0.999	0.597
15	1.8	4.3	3.05	20.9	60.8	40.85	0.496	1.068	0.999	0.521
16	3.8	3.4	3.6	10.4	18.6	61.4	0.758	1.22	1.715	1.231
17	2.5	2.8	2.65	58.9	28.9	43.9	0.954	0.943	0.900	0.632
18	4.2	6.3	5.25	23.7	106.2	64.95	0.971	0.556	0.900	0.509
19	3.1	9.3	6.2	29	38.2	33.6	1.257	1.096	0.900	0.784
20	8.5	6.1	7.3	24.8	22.8	23.8	0.895	0.693	0.900	0.529
21	5.6	4.2	4.9	27.2	28.2	27.7	0.799	0.53	1.736	1.022
22	6.4	3.6	5	22.7	39.7	31.2	0.683	0.814	1.676	1.058
23	4.4	4.3	4.35	22.8	88.3	55.55	1.02	0.78	1.629	1.143
24	3.6	5.7	4.65	39	38.8	38.9	0.883	0.777	0.903	0.854
25	3.5	4.4	3.95	26.3	32.4	29.35	0.999	1.82	1.353	0.058
26	3.9	6.4	5.15	29.1	29.2	29.15	0.892	0.856	0.751	0.833
27	5.2	5.3	5.25	50.5	36.6	43.55	0.999	1.034	0.459	0.498
28	4.7	4.3	4.5	57.1	32.6	44.85	1.868	0.692	0.651	1.070
29	4.2	5.8	5	22.7	31.1	26.9	1.13	0.853	0.502	0.828
30	3	3.7	3.35	33.5	23.1	28.3	0.699	1.288	0.820	0.936
31	3.6	3.7	3.65	46.7	39.5	43.1	1.618	0.538	1.997	1.384
32	3.5	3.5	3.5	15.4	42.8	29.1	0.924	0.72	1.216	0.953
33	2.5	2.4	2.45	23	42.3	32.65	1.4	0.687	1.409	1.165
34	2.2	3.8	3	15.7	13	14.35	0.616	0.954	1.940	1.170
35	2	4.8	3.4	21.9	22.3	22.1	0.672	0.718	1.941	1.110
36	1	2	1.5	18.5	19.7	19.1	0.614	0.761	1.867	1.081
37	2.5	2.2	2.35	19.5	20.8	20.15	0.5	0.808	1.321	0.876
38	2.2	2.7	2.45	17.9	50.4	34.15	0.426	1.026	1.430	0.961
39	2	2	2	21.1	40.7	30.9	1.579	0.808	1.290	1.226
40	1.7	1.8	1.75	20.9	23.3	22.1	0.614	1.365	1.392	1.124
41	2.1	2.9	2.5	22.5	37.8	30.15	1.164	0.896	1.275	1.112
42	1.2	3.2	2.2	13	27	20	0.889	0.588	1.519	0.999
43	1	2.1	1.55	15.4	54.9	35.15	0.716	0.93	1.027	0.891
44	1.2	3.1	2.15	17.8	26.1	21.95	0.567	0.698	1.654	0.973
45	1.5	2.8	2.15	16.3	17.1	16.7	0.541	1.544	1.454	1.180
46	1.4	2.9	2.15	17.2	35.9	26.55	1.171	0.829	0.900	0.667
47	1.3	2.5	1.9	26	22	24	1.899	1.253	0.900	0.051
48	2.2	2	2.1	41.3	31	36.15	1.711	0.949	1.716	1.459
49	3.2	3	3.1	24	28.5	26.25	0.798	0.58	1.047	0.808
50	2.9	3.2	3.05	23.4	19.5	21.45	1.109	0.999	1.985	0.031
51	2.6	2.2	2.4	17.4	29.9	23.65	1.398	1.691	1.582	1.557

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH2	CH2	Avg of CH2	CH2	CH2	Avg of CH2	CH2	CH2	CH2	Avg of CH2
52	5	3.2	4.1	15.5	24.7	20.1	0.857	0.991	0.677	0.842
53	3.8	2.1	2.95	12.6	27.9	20.25	1.112	0.952	0.529	0.864
54	2.2	2	2.1	13.8	29.4	21.6	1.302	0.824	1.376	1.167
55	3.4	2	2.7	24	34.8	29.4	0.999	0.717	0.698	0.472
56	2.3	1.9	2.1	9.2	62.3	35.75	0.999	0.598	1.237	0.612
57	1.2	1.7	1.45	1	38.2	19.6	0.999	0.522	0.935	0.486
58	2.2	1.4	1.8	0.2	34.5	17.35	1.699	0.728	1.169	1.199
59	1.4	1.9	1.65	25.8	25.8	25.8	1.388	0.923	1.454	1.255
60	1.9	2.2	2.05	47.4	47.4	47.4	1.908	1.187	1.011	1.369
61	1.8	2.4	2.1	19.2	19.2	19.2	0.933	1.112	0.845	0.963
62	1.8	2.7	2.25	15.7	15.7	15.7	0.113	0.731	0.900	0.281
63	1.9	2.3	2.1	43.8	43.8	43.8	0.061	0.595	1.916	0.857
64	1.9	3.2	2.55	7.4	7.4	7.4	0.005	0.952	1.290	0.749
65	1.9	2.2	2.05	2	2	2	1.0315	0.742	1.321	1.032

Table: Set 3 data for channel three (input II) modified model

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	CH3	Avg of CH3
1	0.2	0.4	0.3	0.1	0.1	0.1	0.02	0.01	0.01	0.014
2	0.1	0.2	0.15	0.2	2.1	1.15	0.04	0.08	0.01	0.045
3	1.5	1.5	1.5	0.6	14.3	7.45	0.01	0.82	0.59	0.471
4	2.1	0.8	1.45	11	12.4	11.7	0.22	0.31	0.80	0.441
5	3.2	2.1	2.65	2.8	22.9	12.85	0.49	0.72	0.96	0.725
6	2.8	4.2	3.5	9.9	49.2	29.55	0.66	1.59	1.18	1.142
7	2.6	2.9	2.75	10.2	29.8	20	1.24	1.64	0.90	1.261
8	2.4	3.2	2.8	62.8	60.3	61.55	0.90	0.90	0.90	0.900
9	3.1	2.8	2.95	44	22.4	33.2	1.92	0.90	0.90	1.241
10	4	3	3.5	51.9	34.8	43.35	1.57	1.64	1.67	1.630
11	4.8	5.2	5	23.8	23.8	23.8	0.90	0.90	0.90	0.900
12	2.3	2.3	2.3	28.9	23.4	26.15	1.20	1.24	0.90	1.112
13	2.2	2.3	2.25	36.8	27.3	32.05	1.37	0.90	0.90	1.055
14	2.3	3.3	2.8	47.6	61.7	54.65	0.47	1.38	0.90	0.919
15	2.6	4.1	3.35	17.7	51.3	34.5	0.72	1.11	0.90	0.909
16	6.6	3.7	5.15	36.2	27.1	31.65	0.74	1.19	1.96	1.297

	Acceleration (m/s^2)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	CH3	Avg of CH3
17	3.8	2.8	3.3	77.4	34.4	55.9	1.24	1.02	0.90	1.053
18	3.3	4.6	3.95	44.9	26.8	35.85	0.84	0.52	0.90	0.753
19	4	10.3	7.15	47.3	92	69.65	0.91	1.59	0.90	1.133
20	5.9	6.3	6.1	24.5	47	35.75	1.02	0.89	0.90	0.937
21	10.8	6.3	8.55	16.6	31.5	24.05	1.00	0.55	1.70	1.084
22	6.2	5.1	5.65	26.5	35.8	31.15	0.75	0.65	0.90	0.764
23	3.8	6.2	5	17.9	56.4	37.15	1.38	0.70	1.34	1.139
24	4.1	6.6	5.35	40.4	40.7	40.55	1.28	0.69	1.03	0.999
25	5.2	6.2	5.7	23	28.4	25.7	0.90	1.65	1.28	1.273
26	4.4	9.1	6.75	23.6	26.2	24.9	1.75	0.97	0.56	1.093
27	8	8.9	8.45	40.3	38.4	39.35	1.24	0.74	0.44	0.807
28	5.8	6.2	6	30.1	40.6	35.35	0.90	0.84	0.49	0.746
29	3.5	6.5	5	40	39.9	39.95	0.93	0.64	0.54	0.706
30	7.8	5.4	6.6	26.6	33.4	30	0.57	1.13	1.18	0.959
31	4.5	3.3	3.9	26.1	20.2	23.15	1.00	0.79	1.69	1.159
32	3.3	2.6	2.95	21.2	44.6	32.9	1.07	0.98	1.43	1.160
33	2.3	3	2.65	31.5	21.7	26.6	0.98	0.59	1.49	1.016
34	1.8	5.7	3.75	19.4	19.1	19.25	0.51	0.81	1.95	1.089
35	2.3	5.2	3.75	13.8	14.4	14.1	0.66	1.37	1.95	1.327
36	1.2	2.4	1.8	22.2	19.4	20.8	0.49	0.70	1.78	0.987
37	3.5	2	2.75	27.5	29.4	28.45	0.45	0.82	1.30	0.857
38	2.5	2.8	2.65	10.4	51.9	31.15	0.38	0.92	1.37	0.891
39	2.9	2.5	2.7	22.9	36.9	29.9	1.15	0.84	1.37	1.120
40	1.5	2	1.75	14.8	19.2	17	0.54	0.79	1.36	0.896
41	1.9	2.8	2.35	17.1	53	35.05	0.80	0.59	1.36	0.918
42	1.3	3.2	2.25	15.9	61.5	38.7	1.22	0.91	1.00	1.044
43	1.2	2.1	1.65	28.8	60.8	44.8	1.20	0.86	1.42	1.158
44	1.6	3.6	2.6	13.8	24.7	19.25	0.46	1.02	1.40	0.961
45	1.9	1.9	1.9	21.9	26.8	24.35	0.77	1.71	1.85	1.445
46	1.5	2.3	1.9	16.2	35.8	26	1.27	0.74	1.72	1.242
47	2.1	2	2.05	18.3	21.1	19.7	0.90	1.14	1.96	1.333
48	2.2	1.9	2.05	28.1	44	36.05	1.53	0.76	1.52	1.269
49	3.3	2.4	2.85	28.8	47.6	38.2	0.58	0.56	1.13	0.756
50	2.3	5.1	3.7	31.6	21.9	26.75	1.08	1.48	1.74	1.433
51	3.9	2.7	3.3	19.9	25.7	22.8	1.33	1.81	1.01	1.380
52	3.4	3	3.2	18.1	20.5	19.3	1.49	0.49	1.20	1.062
53	5.3	1.8	3.55	13.6	49.1	31.35	1.04	1.02	0.60	0.886

	Acceleration (m/s²)			Velocity (mm/s)			P-P Displacement (mm)			
SL.	CH3	CH3	Avg of CH3	CH3	CH3	Avg of CH3	CH3	CH3	CH3	Avg of CH3
54	2.8	1.9	2.35	13.3	26.5	19.9	1.01	1.01	1.43	1.150
55	3.8	1.9	2.85	17.3	56.9	37.1	0.90	1.23	0.74	0.957
56	2.3	1.9	2.1	8.9	29.1	19	0.90	0.51	0.69	0.701
57	1.9	2	1.95	1.3	32	16.65	0.90	0.51	0.83	0.746
58	2.3	2.2	2.25	0.3	28.9	14.6	1.72	0.72	1.04	1.159
59	1.5	2.3	1.9	33.3	33.3	33.3	1.89	0.54	1.78	1.404
60	1.5	1.7	1.6	37.5	37.5	37.5	0.90	1.36	1.58	1.282
61	1.8	2.6	2.2	21	21	21	0.93	1.48	0.67	1.027
62	1.7	2.4	2.05	10.4	10.4	10.4	0.20	0.94	0.90	0.678
63	2.1	2.1	2.1	31.3	31.3	31.3	0.06	0.89	1.78	0.910
64	1.9	2.7	2.3	9.8	9.8	9.8	0.01	1.00	1.59	0.866
65	2.5	2.4	2.45	1.6	1.6	1.6	1.63	0.95	1.63	1.406

Table: Resultant average channel one (output) data of conventional model

	Acceleration (m/s²)				**velocity (mm/s)**				**Displacement (P-P) mm**			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
1	0.9	1.6	1.1	1.2	13.6	9.55	9.25	10.80	0.492	0.432	0.021	0.315
2	0.7	1.75	1.4	1.28	9.65	12.25	11	10.97	0.347	0.4185	0.3155	0.360
3	0.6	2.15	1.4	1.38	12	8.15	12.4	10.85	0.484	0.4725	0.2645	0.407
4	0.6	1.95	0.95	1.17	20.55	11.8	9.05	13.80	0.359	0.3135	0.2735	0.315
5	0.55	1.75	1.15	1.15	10.35	9.7	13.35	11.13	0.364	0.4605	0.351	0.392
6	0.55	2.15	1.5	1.40	11.05	8.85	9.4	9.77	0.3105	0.5435	0.69	0.515
7	0.6	2.35	1.05	1.33	18.4	12	9.4	13.27	0.384	0.591	0.4495	0.475
8	0.65	2.45	1.95	1.68	15.5	8.7	16.7	13.63	0.5925	0.2735	0.518	0.461
9	8.2	2.05	1.85	4.03	9.15	13.1	10.7	10.98	0.4285	0.3455	0.373	0.382
10	1.25	2.3	2.05	1.87	19.75	12.3	9.05	13.70	0.353	0.393	0.5335	0.427
11	1.2	1.8	1.3	1.43	11.9	11.6	8.55	10.68	0.38	0.2455	0.532	0.386
12	1	1.65	1.65	1.43	11.7	10.3	12.25	11.42	0.3595	0.298	0.424	0.361
13	0.9	1.8	1.9	1.53	12.8	11.2	10.55	11.52	0.573	0.727	0.776	0.692
14	0.8	1.5	1.85	1.38	10.7	11.15	12.85	11.57	0.5285	0.3605	0.5035	0.464
15	0.65	1.65	1.9	1.40	11.75	11.5	13.1	12.12	0.447	0.3105	0.677	0.478
16	0.85	1.55	1.9	1.43	6.25	11.45	7.65	8.45	0.5265	0.377	0.6765	0.527
17	1.15	1.4	1.55	1.37	9.25	12.1	9.3	10.22	0.439	0.241	0.5785	0.420
18	1.2	1.35	2	1.52	9	15.3	9.9	11.40	0.508	0.3075	0.5745	0.463
19	1.3	1.3	1.45	1.35	9.95	11.75	11.55	11.08	0.4095	0.366	0.5185	0.431

	Acceleration (m/s^2)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
20	1.45	1	1.4	1.28	11.95	20.05	9.15	13.72	0.5395	0.3125	0.6525	0.502
21	1.25	1.35	1.4	1.33	10.1	9.35	13.25	10.90	0.8155	0.2835	0.4455	0.515
22	1.75	1.35	1	1.37	12.5	9.85	16.95	13.10	0.57	0.3725	0.6685	0.537
23	1.85	1.05	1.8	1.57	7.2	13.4	18.15	12.92	0.562	0.323	0.513	0.466
24	1.75	1.3	1.15	1.40	11.15	22.4	11.8	15.12	0.6685	0.4815	0.784	0.645
25	1.75	1.25	1.1	1.37	10.9	16.95	11.75	13.20	0.7375	0.311	0.4995	0.516
26	1.7	1	0.95	1.22	12	14.6	11.1	12.57	0.5915	0.354	0.4605	0.469
27	1.15	1.05	1.1	1.10	8.5	14.55	13.85	12.30	0.4505	0.5065	0.5615	0.506
28	1.55	1.1	0.9	1.18	10.65	13.1	12.35	12.03	0.4835	0.469	0.4495	0.467
29	1.55	1.2	0.95	1.23	11.35	13.6	13.55	12.83	0.6155	0.3415	0.3745	0.444
30	1.25	1.1	1	1.12	10.05	13.95	12	12.00	0.505	0.364	0.5525	0.474
31	1.4	1	1.15	1.18	12.85	14.7	12.3	13.28	0.853	0.397	0.5115	0.587
32	1.35	0.85	1.1	1.10	11.25	14	12.45	12.57	0.594	0.4025	0.4685	0.488
33	1.25	0.95	1.45	1.22	7.55	10.45	17.25	11.75	0.3985	0.4195	0.775	0.531
34	1.25	0.9	1.4	1.18	10.2	11.3	6.65	9.38	0.4285	0.4575	0.658	0.515
35	1.15	1.05	1.5	1.23	9.5	11	8.95	9.82	0.43	0.314	0.7985	0.514
36	1.2	0.95	1.7	1.28	11.85	14.15	10.1	12.03	0.451	0.3685	0.7685	0.529
37	1.05	0.95	1.65	1.22	7.1	12.35	11.35	10.27	0.5365	0.4205	0.442	0.466
38	1.1	0.8	1.6	1.17	12.95	10.15	13.35	12.15	0.611	0.3225	0.432	0.455
39	1.45	0.8	1.25	1.17	14.45	11.95	7.75	11.38	0.2905	0.3945	1.078	0.588
40	1.4	0.75	1.55	1.23	7.75	11.4	8.3	9.15	0.5125	0.4205	0.6885	0.541
41	1.15	0.85	0.95	0.98	14.45	13.7	11.55	13.23	0.558	0.293	0.4375	0.430
42	1.4	0.75	1.15	1.10	7.05	7.4	8.4	7.62	0.4815	0.32	0.7835	0.528
43	1.4	0.75	1.1	1.08	10.45	7.5	12.4	10.12	0.4105	0.585	0.4505	0.482
44	1.8	0.9	0.95	1.22	12.4	8.5	10.1	10.33	0.521	0.4105	0.369	0.434
45	2.5	0.8	0.85	1.38	10.45	8.25	12.25	10.32	0.701	0.4875	0.7785	0.656
46	1.15	0.65	0.9	0.90	12	10.2	12.6	11.60	0.462	0.477	0.5635	0.501
47	1.45	0.95	0.95	1.12	9.25	9.25	11.4	9.97	0.5765	0.6095	0.369	0.518
48	1.75	0.75	0.9	1.13	9.85	11.3	12.05	11.07	0.535	0.381	0.989	0.635
49	1.2	1.05	0.85	1.03	9.2	9.3	12.05	10.18	0.6625	0.491	0.3975	0.517
50	0.95	1.5	0.8	1.08	8.5	11.3	9.4	9.73	0.607	0.5245	0.587	0.573
51	0.95	1.05	0.95	0.98	7.85	9.25	8.5	8.53	0.426	0.6115	0.411	0.483
52	0.8	1.1	0.8	0.90	9.2	12.15	13.05	11.47	0.803	0.509	0.8565	0.723
53	0.85	0.9	1	0.92	8	9.75	9.55	9.10	0.447	0.445	0.528	0.473
54	0.7	0.7	0.85	0.75	10.15	11.6	8.3	10.02	0.703	0.4115	1.218	0.778
55	0.8	0.6	1	0.80	6.85	11.35	11.05	9.75	0.426	0.547	0.71	0.561
56	0.9	0.8	0.85	0.85	8.95	8.6	6.9	8.15	0.39	0.4485	0.775	0.538
57	0.8	1	0.85	0.88	7.65	7.75	10.25	8.55	0.557	0.4395	0.781	0.593

	Acceleration (m/s^2)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
58	0.75	1.1	0.75	0.87	6.4	6.25	13.15	8.60	0.454	0.664	0.7115	0.610
59	0.9	1.4	0.8	1.03	9.7	9.45	9.05	9.40	0.382	0.3155	1.088	0.595
60	0.95	1.05	0.9	0.97	10.1	10.35	8.4	9.62	0.387	0.4405	0.843	0.557
61	1.05	0.85	0.9	0.93	5.6	7.95	11.95	8.50	0.442	0.2735	0.5885	0.435
62	0.95	0.75	1.55	1.08	6.7	6.4	8.5	7.20	0.412	0.1945	0.5455	0.384
63	0.85	1	1.1	0.98	5.9	8.25	5.7	6.62	0.416	0.2975	0.992	0.569
64	0.85	1.2	1.05	1.03	7.4	7.65	9.15	8.07	0.407	0.494	0.95	0.617
65	0.9	1	1.2	1.03	5.4	8.25	6.85	6.83	0.331	0.322	0.8	0.484
66	1	1.1	1.1	1.07	6	5.45	7.6	6.35	0.197	0.5125	0.084	0.265
67	1	1.3	0.8	1.03	6.6	8.75	9.65	8.33	0.24	0.743	0.017	0.333
68	1.1	1.1	1.1	1.10	9.2	10.2	9.5	9.63	0.336	0.418	0.015	0.256
69	1.1	1.1	0.95	1.05	8.3	11.2	5.3	8.27	0.311	0.281	0.017	0.203
70	1.3	1.1	1.05	1.15	13	10.9	8.25	10.72	0.445	0.313	0.015	0.258
71	1.1	1	0.95	1.02	10.9	9.55	7.4	9.28	0.523	0.35	0.43	0.434
72	1	1.1	1.35	1.15	6.4	8.15	6.7	7.08	0.337	0.2035	0.335	0.292
73	0.95	1	1	0.98	11.8	8.3	10	10.03	0.334	0.435	0.4	0.390
74	1	1	0.9	0.97	10.5	10.7	9.9	10.37	0.34	0.617	0.567	0.508
75	0.95	1.1	1.2	1.08	10.5	6.65	9.1	8.75	0.335	0.568	0.54	0.481
76	1.05	1.2	1.4	1.22	8.9	9.4	8.4	8.90	0.306	0.377	0.356	0.346
77	1.1	1	1	1.03	7.2	2.9	11.9	7.33	0.368	0.45	0.45	0.423
78	1.35	1.2	1	1.18	6.2	8.3	7.7	7.40	0.389	1.06	0.561	0.670
79	1.1	1.1	1.5	1.23	12	10	8	10.00	0.465	0.738	0.654	0.619
80	1.5	1.4	1.3	1.40	10.9	9.1	7.9	9.30	0.802	0.365	0.546	0.571
81	1.05	0.9	0.8	0.92	10	10	10	10.00	0.506	0.653	0.555	0.571
82	1	1.5	1.7	1.40	9.3	9.3	9.3	9.30	0.589	0.436	0.489	0.505
83	1.2	1.2	1.2	1.20	12.2	12.2	12.2	12.20	0.361	0.452	0.498	0.437
84	0.95	0.95	0.95	0.95	7.5	7.5	7.5	7.50	0.414	0.576	0.499	0.496
85	1	1	1	1.00	9.4	9.4	9.4	9.40	0.335	0.25	0.355	0.313
86	1.05	1.05	1.05	1.05	9.2	9.2	9.2	9.20	0.39	0.397	0.365	0.384
87	1.15	1.15	1.15	1.15	7.1	7.1	7.1	7.10	0.605	0.719	0.657	0.660
88	1.3	1.3	1.3	1.30	13.6	13.6	13.6	13.60	0.47	0.399	0.432	0.434
89	1.05	1.05	1.05	1.05	9.4	9.4	9.4	9.40	0.405	0.444	0.444	0.431
90	1.15	1.15	1.15	1.15	10.6	10.6	10.6	10.60	0.349	0.367	0.369	0.362

Table: Resultant average channel two (input I) data of conventional model

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
1	0.6	1.4	0.65	0.88	24.25	2.4	2.55	9.733	0.6745	0.031	0.0005	0.235
2	0.45	0.9	0.85	0.73	13.1	2.05	2.35	5.833	0.6475	0.038	0.002	0.229
3	0.5	1.6	1.1	1.07	9.75	2.15	2.35	4.750	0.611	0.038	0.0135	0.221
4	0.85	1.45	0.7	1.00	13.35	2.4	2.75	6.167	0.4175	0.0375	0.01	0.155
5	0.35	1.55	0.9	0.93	13.65	2.05	2.65	6.117	0.473	0.0415	0.022	0.179
6	0.6	1.55	1.05	1.07	8.6	2	1.85	4.150	0.313	0.053	0.0275	0.131
7	0.4	2.1	0.75	1.08	14.7	3.65	2.25	6.867	0.584	0.0285	0.024	0.212
8	0.3	2.35	1.6	1.42	36.55	1.8	2.4	13.58	0.4115	0.02	0.0235	0.152
9	14.85	1.9	1.65	6.13	15.55	2.4	2.5	6.817	0.545	0.027	0.023	0.198
10	0.7	1.8	1.75	1.42	9.45	2.55	2.25	4.750	0.428	0.028	0.0285	0.162
11	0.7	1.8	1.1	1.20	12.65	2.65	2	5.767	0.7675	0.025	0.0295	0.274
12	0.8	1.6	1.3	1.23	10.2	2.1	3.3	5.200	0.3945	0.0215	0.029	0.148
13	0.5	1.4	1.45	1.12	11.55	2.2	3.7	5.817	0.581	0.0165	0.0455	0.214
14	0.55	1.25	1.35	1.05	11.1	1.85	2.35	5.100	0.41	0.018	0.0315	0.153
15	0.45	1.35	1.7	1.17	8.9	2.9	2.95	4.917	0.5275	0.0205	0.0375	0.195
16	0.7	1.2	1.45	1.12	8.9	3	2.45	4.783	0.6175	0.03	0.037	0.228
17	0.7	1.1	1.3	1.03	9.3	2.35	1.65	4.433	0.5055	0.0215	0.0385	0.189
18	0.65	1.15	1.45	1.08	9.05	3.05	2.45	4.850	0.5665	0.0245	0.03	0.207
19	1.8	0.9	1.05	1.25	8.75	2.8	2.75	4.767	0.568	0.024	0.0245	0.206
20	1.55	0.8	1.05	1.13	11.5	2.55	2.65	5.567	0.703	0.025	0.0425	0.257
21	1.6	0.9	1	1.17	18.1	2.45	3.1	7.883	0.708	0.0265	0.03	0.255
22	2.15	0.95	0.8	1.30	9.35	2.3	2.6	4.750	0.591	0.0265	0.031	0.216
23	3.35	0.65	0.8	1.60	7.3	3.05	2.6	4.317	0.888	0.0235	0.0245	0.312
24	2.95	0.85	0.7	1.50	8.1	2.3	2.1	4.167	0.766	0.033	0.0595	0.286
25	3.8	0.75	0.65	1.73	14.3	3.05	2	6.450	0.4685	0.0235	0.0295	0.174
26	2.55	0.7	0.75	1.33	9.3	7.4	2.3	6.333	0.838	0.027	0.0255	0.297
27	2.6	0.75	0.7	1.35	8.45	2.25	2.2	4.300	0.7705	0.043	0.0395	0.284
28	4.15	0.7	0.6	1.82	9.55	2.8	2.65	5.000	0.659	0.0275	0.03	0.239
29	2.7	0.75	0.65	1.37	10.7	3.25	2.35	5.433	0.7895	0.028	0.0275	0.282
30	2.55	0.8	0.75	1.37	10.05	4.9	2.65	5.867	0.7235	0.0225	0.0255	0.257
31	2.1	0.7	0.8	1.20	9.95	2.5	2.6	5.017	0.818	0.0365	0.022	0.292
32	3.75	0.55	0.8	1.70	9.2	2.6	2.1	4.633	0.9175	0.032	0.0325	0.327
33	2.55	0.65	0.85	1.35	9.65	2.85	2.25	4.917	0.8685	0.027	0.069	0.322
34	1.75	0.6	0.8	1.05	11.65	2.35	1.4	5.133	0.6445	0.04	0.023	0.236
35	1.45	0.8	0.85	1.03	10.25	2.3	2.1	4.883	0.758	0.0265	0.034	0.273
36	1.75	0.65	0.85	1.08	9.05	2.15	2	4.400	0.469	0.0235	0.037	0.177
37	2.05	0.6	0.9	1.18	11.6	2.2	2.25	5.350	0.5675	0.0375	0.0215	0.209

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
38	1.6	0.6	1	1.07	16.25	2.1	2	6.783	0.4465	0.0345	0.026	0.169
39	1.6	0.65	0.95	1.07	17.55	2.65	1.8	7.333	0.3975	0.028	0.07	0.165
40	1.65	0.6	1	1.08	6.05	3.3	2.05	3.800	0.479	0.0345	0.037	0.184
41	1.45	0.65	0.8	0.97	8.3	2.45	2.4	4.383	0.6845	0.0285	0.025	0.246
42	2	0.55	0.65	1.07	10.75	1.75	1.7	4.733	0.4705	0.029	0.0325	0.177
43	1.75	0.55	0.8	1.03	10.8	2	2.3	5.033	0.5545	0.04	0.0295	0.208
44	2.45	0.65	0.7	1.27	8.75	2.35	2.3	4.467	0.6865	0.028	0.0165	0.244
45	1.9	0.6	0.7	1.07	8	1.85	2.6	4.150	0.4635	0.0355	0.0675	0.189
46	1.5	0.45	0.65	0.87	9.1	2.1	2.3	4.500	0.4915	0.038	0.042	0.191
47	2.55	0.8	0.7	1.35	9.75	2.15	2.45	4.783	0.534	0.0525	0.023	0.203
48	3	0.7	0.7	1.47	7.65	3.6	2	4.417	0.9225	0.035	0.0695	0.342
49	1.9	0.75	0.7	1.12	6.65	2.15	3	3.933	0.641	0.0305	0.0275	0.233
50	1.45	0.8	0.7	0.98	7.3	1.95	2.35	3.867	0.067	0.0375	0.033	0.046
51	1.5	0.8	0.8	1.03	8.05	2.15	1.85	4.017	0.048	0.039	0.0265	0.038
52	1.35	0.75	0.75	0.95	13	1.8	1.9	5.567	0.057	0.048	0.0645	0.057
53	1.4	0.55	0.8	0.92	11.35	1.65	1.4	4.800	0.045	0.0285	0.0415	0.038
54	1.25	0.4	0.75	0.80	12.75	2.5	1.9	5.717	0.074	0.033	0.064	0.057
55	1.4	0.5	0.75	0.88	8.9	3.1	1.8	4.600	0.035	0.0395	0.068	0.048
56	1.3	0.5	0.65	0.82	5.5	1.6	1.55	2.883	0.077	0.0375	0.0565	0.057
57	1.4	0.75	0.7	0.95	7.85	1.7	2.4	3.983	0.042	0.04	0.0465	0.043
58	1.2	0.85	0.6	0.88	9.5	1.4	1.65	4.183	0.041	0.0765	0.0585	0.059
59	1.4	0.95	0.65	1.00	8.45	1.6	2	4.017	0.04	0.0245	0.0785	0.048
60	1.4	0.85	0.7	0.98	1.6	1.6	1.5	1.567	0.033	0.0205	0.05	0.035
61	1.5	0.8	0.8	1.03	1.1	1.5	1.4	1.333	0.032	0.011	0.0435	0.029
62	1.5	0.6	0.9	1.00	1.5	1.35	1.85	1.567	0.033	0.011	0.0375	0.027
63	1.3	0.9	0.85	1.02	1.3	2.05	1.45	1.600	0.025	0.0105	0.075	0.037
64	1.4	1.1	0.85	1.12	1.5	2.1	1.95	1.850	0.029	0.012	0.056	0.032
65	1.35	1	1	1.12	1.1	1.7	1.4	1.400	0.032	0.0265	0.053	0.037
66	1.35	1	0.85	1.07	1.7	1.3	1.65	1.550	0.025	0.041	0.003	0.023
67	1.55	1	0.7	1.08	1.6	1.85	1.7	1.717	0.024	0.0365	0.0302	0.030
68	1.8	1.3	0.8	1.30	1.5	1.5	1.45	1.483	0.024	0.023	0.0235	0.024
69	1.65	1.2	0.75	1.20	1.9	2.05	1.25	1.733	0.041	0.034	0.0375	0.038
70	1.95	1.4	0.85	1.40	4.4	1.6	1.5	2.500	0.038	0.023	0.0305	0.031
71	1.5	1.175	0.85	1.18	2.2	1.75	1.6	1.850	0.033	0.0155	0.0242	0.024
72	1.5	1.125	0.75	1.13	1.7	1.85	1.45	1.667	0.035	0.0175	0.0262	0.026
73	1.5	1.15	0.8	1.15	1.8	2.2	1.9	1.967	0.029	0.034	0.0315	0.032
74	1.55	1.125	0.7	1.13	1.6	2.35	2.8	2.250	0.024	0.024	0.024	0.024
75	1.5	1.2	0.9	1.20	1.8	2	1.7	1.833	0.028	0.025	0.0265	0.027

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
76	1.55	1.275	1	1.28	1.6	3.05	1.6	2.083	0.031	0.028	0.0295	0.030
77	1.5	1.15	0.8	1.15	1.7	0.85	2.1	1.550	0.03	0.018	0.024	0.024
78	2.1	1.55	1	1.55	1.4	1.4	1.9	1.567	0.024	0.06	0.042	0.042
79	1.65	1.225	0.8	1.23	1.8	1.65	1.5	1.650	0.041	0.05	0.0455	0.046
80	3	2	1	2.00	2.6	2.35	2.1	2.350	0.053	0.032	0.0425	0.043
81	1.6	1.2	0.8	1.20	2.4	2.275	2.15	2.275	0.028	0.034	0.031	0.031
82	1.7	1.35	1	1.35	1.5	1.375	1.25	1.375	0.054	0.036	0.045	0.045
83	1.8	1.85	1.9	1.85	2.1	1.975	1.85	1.975	0.049	0.036	0.0425	0.043
84	1.75	1.775	1.8	1.78	1.5	1.375	1.25	1.375	0.074	0.044	0.059	0.059
85	2	1.95	1.9	1.95	1.6	1.475	1.35	1.475	0.038	0.02	0.029	0.029
86	1.7	1.65	1.6	1.65	1.8	1.675	1.55	1.675	0.054	0.024	0.039	0.039
87	1.8	1.7	1.6	1.70	1.5	1.375	1.25	1.375	0.065	0.046	0.0555	0.056
88	1.8	1.75	1.7	1.75	5.6	5.475	5.35	5.475	0.042	0.021	0.0315	0.032
89	1.75	1.675	1.6	1.68	2	1.875	1.75	1.875	0.043	0.025	0.034	0.034
90	1.75	1.675	1.6	1.68	3	2.875	2.75	2.875	0.034	0.021	0.0275	0.028

Table: Resultant average channel three (input II) data of conventional model

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
1	2.3	4.8	2.7	3.267	13.85	19.65	20.6	18.033	0.3995	0.8695	0.009	0.426
2	1	4.4	3.7	3.033	11.6	30.55	29.05	23.733	0.3085	1.113	0.0825	0.501
3	1.35	5.9	7.55	4.933	13.4	22.5	32.35	22.750	0.378	1.1015	0.4695	0.650
4	1.5	9.05	2.3	4.283	11.5	23.7	30.15	21.783	0.3855	0.775	0.261	0.474
5	1.35	4.75	2.3	2.800	11.85	22.2	39.25	24.433	0.428	1.1725	0.4775	0.693
6	1.05	5.95	2.9	3.300	12.15	24	21.5	19.217	0.1685	1.472	0.6325	0.758
7	1.1	5.5	3.4	3.333	14.65	26.4	22.45	21.167	0.346	0.7805	0.6805	0.602
8	0.8	11.05	5.7	5.850	16.5	24.45	42.2	27.717	0.3425	0.43	0.8945	0.556
9	4.5	11.8	5.75	7.350	18.5	36.3	28	27.600	0.2755	0.503	0.748	0.509
10	1.35	4.05	7.4	4.267	10.55	24.85	17.9	17.767	0.226	0.6105	0.75	0.529
11	2	5.85	4.2	4.017	17.9	33.7	23.45	25.017	0.3215	0.559	0.9165	0.599
12	1.65	4.2	7.45	4.433	11.35	31.45	81.4	41.400	0.5195	0.746	0.694	0.653
13	2.3	5.75	8.75	5.600	12.35	27.4	27.45	22.400	0.432	0.667	0.759	0.619
14	2.85	5.35	4.95	4.383	10.9	21.7	26.65	19.750	0.4155	0.3815	0.858	0.552
15	1.65	5.25	7.05	4.650	15.95	42.95	27.55	28.817	0.465	0.5855	1.0955	0.715
16	2.15	3.65	5.15	3.650	10.25	28.3	20.75	19.767	0.4575	0.6785	0.9205	0.686

	Acceleration (m/s^2)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
17	1.7	3.75	4.55	3.333	28.5	27.5	23.9	26.633	0.596	0.534	0.7895	0.640
18	2.15	3.45	5.7	3.767	11.6	26.9	26.6	21.700	0.5715	0.7095	0.8525	0.711
19	2.2	3.15	4.15	3.167	14.4	26	43.15	27.850	0.446	0.896	0.718	0.687
20	2.25	2.85	4.15	3.083	14.6	25.25	26.25	22.033	0.36	0.713	0.879	0.651
21	3.1	2.95	2.85	2.967	12.6	29.6	35.7	25.967	0.6905	0.7085	0.7235	0.708
22	2.95	3.65	2.5	3.033	20.65	33.05	25.8	26.500	0.6195	0.8745	0.8065	0.767
23	1.95	3.3	3.85	3.033	12.8	47.6	27.05	29.150	0.329	0.8055	0.6955	0.610
24	3.25	2.75	2.6	2.867	20.5	28.5	26.1	25.033	0.939	0.926	1.1965	1.021
25	1.95	2.3	2.45	2.233	16.25	58.45	20.25	31.650	0.5035	0.6915	0.81	0.668
26	1.35	2.35	2.6	2.100	28.1	41.05	25.25	31.467	0.4065	0.821	0.713	0.647
27	1.3	2.3	3	2.200	16.9	34.35	22.8	24.683	0.615	1.183	0.9185	0.906
28	2.05	2.6	2.65	2.433	9.8	56.8	21.7	29.433	0.595	0.7565	0.657	0.670
29	2.05	3	2.4	2.483	10.25	50.6	35.8	32.217	0.6835	0.7475	0.7555	0.729
30	2.1	2.7	1.95	2.250	17.25	36.1	20.5	24.617	0.5585	0.572	0.5455	0.559
31	2.5	2.25	2.85	2.533	13	31.15	21.6	21.917	0.8405	0.8945	0.966	0.900
32	2.45	1.8	2.95	2.400	22.55	24.8	30.3	25.883	0.6275	0.7465	0.718	0.697
33	1.7	2.35	2.35	2.133	11.4	20.05	23.05	18.167	0.5225	0.8345	0.854	0.737
34	1.85	1.9	4	2.583	14.8	26.4	13.45	18.217	0.5515	0.8695	0.9495	0.790
35	1.8	2.6	3.35	2.583	13.4	27	40	26.800	0.4505	0.8595	0.97	0.760
36	1.65	2.6	4.35	2.867	15.9	45.4	35.3	32.200	0.4305	0.6685	0.833	0.644
37	2.45	2.05	4	2.833	10.05	19.1	28.35	19.167	0.6195	1.041	0.8705	0.844
38	2.35	2.85	2.5	2.567	11.65	34.4	22.7	22.917	0.725	0.8865	0.6415	0.751
39	1.75	2.65	2.45	2.283	9.65	23.35	20.4	17.800	0.4435	0.9535	1.295	0.897
40	3.25	1.9	3.1	2.750	9.85	42.05	18.3	23.400	0.7935	0.7315	0.9585	0.828
41	1.55	2.1	1.9	1.850	14.95	25.95	22.35	21.083	0.7695	0.613	0.6115	0.665
42	1.6	2.1	2.55	2.083	20.95	19.8	21.95	20.900	0.5745	0.8035	1.029	0.802
43	1.55	2.2	2.4	2.050	20.05	21.7	25.4	22.383	0.781	0.999	0.9395	0.907
44	2.35	1.8	2.15	2.100	12.1	23.7	25.35	20.383	0.56	0.792	0.543	0.632
45	2.3	2.2	2.25	2.250	14.6	27.8	25.75	22.717	0.8765	1.055	0.955	0.962
46	2.25	1.7	2.1	2.017	23.8	28.8	31.05	27.883	0.652	0.9975	0.905	0.852
47	1.5	2.4	2.7	2.200	14.05	24.2	23.95	20.733	0.5895	1.3685	0.569	0.842
48	2.4	2.05	2.2	2.217	10.4	28.45	52.8	30.550	0.4795	0.981	0.9815	0.814
49	1.6	2.35	2.55	2.167	11	18.85	28.4	19.417	0.5295	0.801	0.8905	0.740
50	1.5	2.75	1.9	2.050	10.5	22.5	15.15	16.050	1.463	1.072	0.869	1.135
51	1.3	2.4	2.25	1.983	7	22.2	21.2	16.800	1.361	0.75	0.528	0.880
52	1.1	3.6	2.1	2.267	10.45	23.25	20	17.900	1.156	1.224	1.9105	1.430
53	1.35	2.15	2.3	1.933	7.15	29.4	13.85	16.800	0.976	0.738	1.109	0.941
54	1.1	1.05	2.3	1.483	10.8	38.4	20.75	23.317	1.649	0.6255	1.25	1.175

	Acceleration (m/s^2)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
55	1.3	1.1	2.5	1.633	10.2	24.3	17.25	17.250	1.06	1.45	1.3025	1.271
56	1.6	1.4	1.95	1.650	11.55	16.45	20.85	16.283	1.102	0.983	1.25	1.112
57	1.05	2.7	1.85	1.867	8.2	13.65	18.45	13.433	1.226	0.924	1.1845	1.112
58	1.45	3.6	1.75	2.267	8.3	16.1	23.25	15.883	1.564	1.4915	1.0585	1.371
59	1.85	3.55	1.65	2.350	9.05	51.2	22.45	27.567	1.038	0.6975	1.25	0.995
60	1.55	2.4	3.2	2.383	30.1	30.55	19.4	26.683	1.13	0.5245	1.5805	1.078
61	1.45	1.65	2.35	1.817	9.1	20.85	17.75	15.900	0.952	0.3485	0.823	0.708
62	1.45	1.65	3.05	2.050	13.5	20.4	19.35	17.750	0.894	0.4305	0.944	0.756
63	1.25	3	2.8	2.350	15.2	20.55	12.05	15.933	1.006	0.4545	1.818	1.093
64	1.05	3.6	2.15	2.267	13.2	20.2	20.65	18.017	0.794	0.292	1.318	0.801
65	1.35	2.5	2.85	2.233	8.2	14.7	14.75	12.550	1.108	0.471	1.339	0.973
66	1.55	3.4	2.35	2.433	17.5	18.65	18.15	18.100	0.904	1.305	0.139	0.783
67	1.8	3.9	1.85	2.517	14.9	22.6	13.65	17.050	0.713	0.846	0.018	0.526
68	1.95	2.01	2.55	2.170	23.1	17.8	15.15	18.683	0.725	0.8855	0.01	0.540
69	2.15	2.35	2.65	2.383	17.6	28.4	14.25	20.083	0.88	0.8055	0.014	0.567
70	1.55	2.9	2.8	2.417	38.9	18.8	19.55	25.750	1.226	0.714	0.01	0.650
71	1.8	2.67	2.55	2.340	24.6	18.85	18.7	20.717	0.882	0.457	0.6695	0.670
72	2.05	2.95	2.8	2.600	24.4	27.85	15.95	22.733	0.854	0.4195	0.6367	0.637
73	1.35	2.84	2.75	2.313	21.6	18.85	33.9	24.783	0.7	0.736	0.718	0.718
74	1.85	2.45	2.3	2.200	25	20.3	24.9	23.400	0.67	0.588	0.629	0.629
75	1.85	3.25	3.2	2.767	28.5	18.55	14.1	20.383	0.711	1.132	0.9215	0.922
76	1.6	3.45	3.2	2.750	18.3	16.55	16.9	17.250	0.916	0.818	0.867	0.867
77	2.95	3.01	2.2	2.720	24	8.8	15.8	16.200	0.924	0.606	0.765	0.765
78	1.85	2.56	2	2.137	18.3	18.8	43.4	26.833	0.601	1.301	0.951	0.951
79	1.8	2.01	2.2	2.003	15	22.06	21.6	19.553	1.384	1.591	1.4875	1.488
80	2	2.89	2.9	2.597	32.5	34.5	33.5	33.500	1.978	0.718	1.348	1.348
81	1.45	2.32	2.3	2.023	59.9	60.05	62.45	60.800	1.545	0.89	1.2175	1.218
82	1.9	2.01	2.5	2.137	33.8	35.5	35.56	34.953	1.597	1.008	1.3025	1.303
83	1.9	1.99	2.05	1.980	38	40.45	39.54	39.330	1.244	0.733	0.9885	0.989
84	1.7	1.86	2.65	2.070	20.4	25.5	25.45	23.783	1.069	0.951	1.01	1.010
85	1.2	1.56	1.6	1.453	30.5	35.5	35.52	33.840	0.906	0.519	0.7125	0.713
86	1.5	1.65	1.65	1.600	22.1	25.48	24.64	24.073	1.462	0.579	1.0205	1.021
87	1.4	1.89	1.9	1.730	21	22.56	22.54	22.033	1.579	1.012	1.2955	1.296
88	4.85	3.59	3.5	3.980	44.5	45.5	46.56	45.520	1.338	0.661	0.9995	1.000
89	1.55	2.1	2.66	2.103	13.7	15.6	14.56	14.620	0.842	0.615	0.7285	0.729
90	1.7	1.98	1.99	1.890	21.6	22.6	23.54	22.580	0.8	0.502	0.651	0.651

Table: Resultant average input data of conventional model

	Acceleration (m/s^2)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
1	0.88	3.27	2.08	9.733	18.03	13.883	0.235	0.426	0.3307
2	0.73	3.03	1.88	5.833	23.73	14.783	0.229	0.501	0.3653
3	1.07	4.93	3.00	4.750	22.75	13.750	0.221	0.650	0.4353
4	1.00	4.28	2.64	6.167	21.78	13.975	0.155	0.474	0.3144
5	0.93	2.80	1.87	6.117	24.43	15.275	0.179	0.693	0.4358
6	1.07	3.30	2.18	4.150	19.22	11.683	0.131	0.758	0.4444
7	1.08	3.33	2.21	6.867	21.17	14.017	0.212	0.602	0.4073
8	1.42	5.85	3.63	13.583	27.72	20.650	0.152	0.556	0.3537
9	6.13	7.35	6.74	6.817	27.60	17.208	0.198	0.509	0.3536
10	1.42	4.27	2.84	4.750	17.77	11.258	0.162	0.529	0.3452
11	1.20	4.02	2.61	5.767	25.02	15.392	0.274	0.599	0.4365
12	1.23	4.43	2.83	5.200	41.40	23.300	0.148	0.653	0.4008
13	1.12	5.60	3.36	5.817	22.40	14.108	0.214	0.619	0.4168
14	1.05	4.38	2.72	5.100	19.75	12.425	0.153	0.552	0.3524
15	1.17	4.65	2.91	4.917	28.82	16.867	0.195	0.715	0.4553
16	1.12	3.65	2.38	4.783	19.77	12.275	0.228	0.686	0.4568
17	1.03	3.33	2.18	4.433	26.63	15.533	0.189	0.640	0.4142
18	1.08	3.77	2.43	4.850	21.70	13.275	0.207	0.711	0.4591
19	1.25	3.17	2.21	4.767	27.85	16.308	0.206	0.687	0.4461
20	1.13	3.08	2.11	5.567	22.03	13.800	0.257	0.651	0.4538
21	1.17	2.97	2.07	7.883	25.97	16.925	0.255	0.708	0.4812
22	1.30	3.03	2.17	4.750	26.50	15.625	0.216	0.767	0.4915
23	1.60	3.03	2.32	4.317	29.15	16.733	0.312	0.610	0.4610
24	1.50	2.87	2.18	4.167	25.03	14.600	0.286	1.021	0.6533
25	1.73	2.23	1.98	6.450	31.65	19.050	0.174	0.668	0.4211
26	1.33	2.10	1.72	6.333	31.47	18.900	0.297	0.647	0.4718
27	1.35	2.20	1.78	4.300	24.68	14.492	0.284	0.906	0.5949
28	1.82	2.43	2.13	5.000	29.43	17.217	0.239	0.670	0.4542
29	1.37	2.48	1.93	5.433	32.22	18.825	0.282	0.729	0.5053
30	1.37	2.25	1.81	5.867	24.62	15.242	0.257	0.559	0.4079
31	1.20	2.53	1.87	5.017	21.92	13.467	0.292	0.900	0.5963
32	1.70	2.40	2.05	4.633	25.88	15.258	0.327	0.697	0.5123
33	1.35	2.13	1.74	4.917	18.17	11.542	0.322	0.737	0.5293
34	1.05	2.58	1.82	5.133	18.22	11.675	0.236	0.790	0.5130
35	1.03	2.58	1.81	4.883	26.80	15.842	0.273	0.760	0.5164
36	1.08	2.87	1.98	4.400	32.20	18.300	0.177	0.644	0.4103
37	1.18	2.83	2.01	5.350	19.17	12.258	0.209	0.844	0.5263

	Acceleration (m/s^2)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
38	1.07	2.57	1.82	6.783	22.92	14.850	0.169	0.751	0.4600
39	1.07	2.28	1.68	7.333	17.80	12.567	0.165	0.897	0.5313
40	1.08	2.75	1.92	3.800	23.40	13.600	0.184	0.828	0.5057
41	0.97	1.85	1.41	4.383	21.08	12.733	0.246	0.665	0.4553
42	1.07	2.08	1.58	4.733	20.90	12.817	0.177	0.802	0.4898
43	1.03	2.05	1.54	5.033	22.38	13.708	0.208	0.907	0.5573
44	1.27	2.10	1.68	4.467	20.38	12.425	0.244	0.632	0.4377
45	1.07	2.25	1.66	4.150	22.72	13.433	0.189	0.962	0.5755
46	0.87	2.02	1.44	4.500	27.88	16.192	0.191	0.852	0.5210
47	1.35	2.20	1.78	4.783	20.73	12.758	0.203	0.842	0.5228
48	1.47	2.22	1.84	4.417	30.55	17.483	0.342	0.814	0.5782
49	1.12	2.17	1.64	3.933	19.42	11.675	0.233	0.740	0.4867
50	0.98	2.05	1.52	3.867	16.05	9.958	0.046	1.135	0.5903
51	1.03	1.98	1.51	4.017	16.80	10.408	0.038	0.880	0.4588
52	0.95	2.27	1.61	5.567	17.90	11.733	0.057	1.430	0.7433
53	0.92	1.93	1.43	4.800	16.80	10.800	0.038	0.941	0.4897
54	0.80	1.48	1.14	5.717	23.32	14.517	0.057	1.175	0.6159
55	0.88	1.63	1.26	4.600	17.25	10.925	0.048	1.271	0.6592
56	0.82	1.65	1.23	2.883	16.28	9.583	0.057	1.112	0.5843
57	0.95	1.87	1.41	3.983	13.43	8.708	0.043	1.112	0.5772
58	0.88	2.27	1.58	4.183	15.88	10.033	0.059	1.371	0.7150
59	1.00	2.35	1.68	4.017	27.57	15.792	0.048	0.995	0.5214
60	0.98	2.38	1.68	1.567	26.68	14.125	0.035	1.078	0.5564
61	1.03	1.82	1.43	1.333	15.90	8.617	0.029	0.708	0.3683
62	1.00	2.05	1.53	1.567	17.75	9.658	0.027	0.756	0.3917
63	1.02	2.35	1.68	1.600	15.93	8.767	0.037	1.093	0.5648
64	1.12	2.27	1.69	1.850	18.02	9.933	0.032	0.801	0.4168
65	1.12	2.23	1.68	1.400	12.55	6.975	0.037	0.973	0.5049
66	1.07	2.43	1.75	1.550	18.10	9.825	0.023	0.783	0.4028
67	1.08	2.52	1.80	1.717	17.05	9.383	0.030	0.526	0.2780
68	1.30	2.17	1.74	1.483	18.68	10.083	0.024	0.540	0.2818
69	1.20	2.38	1.79	1.733	20.08	10.908	0.038	0.567	0.3020
70	1.40	2.42	1.91	2.500	25.75	14.125	0.031	0.650	0.3403
71	1.18	2.34	1.76	1.850	20.72	11.283	0.024	0.670	0.3469
72	1.13	2.60	1.86	1.667	22.73	12.200	0.026	0.637	0.3315
73	1.15	2.31	1.73	1.967	24.78	13.375	0.032	0.718	0.3748
74	1.13	2.20	1.66	2.250	23.40	12.825	0.024	0.629	0.3265
75	1.20	2.77	1.98	1.833	20.38	11.108	0.027	0.922	0.4740

	Acceleration (m/s²)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
76	1.28	2.75	2.01	2.083	17.25	9.667	0.030	0.867	0.4483
77	1.15	2.72	1.94	1.550	16.20	8.875	0.024	0.765	0.3945
78	1.55	2.14	1.84	1.567	26.83	14.200	0.042	0.951	0.4965
79	1.23	2.00	1.61	1.650	19.55	10.602	0.046	1.488	0.7665
80	2.00	2.60	2.30	2.350	33.50	17.925	0.043	1.348	0.6953
81	1.20	2.02	1.61	2.275	60.80	31.538	0.031	1.218	0.6243
82	1.35	2.14	1.74	1.375	34.95	18.164	0.045	1.303	0.6738
83	1.85	1.98	1.92	1.975	39.33	20.653	0.043	0.989	0.5155
84	1.78	2.07	1.92	1.375	23.78	12.579	0.059	1.010	0.5345
85	1.95	1.45	1.70	1.475	33.84	17.658	0.029	0.713	0.3708
86	1.65	1.60	1.63	1.675	24.07	12.874	0.039	1.021	0.5298
87	1.70	1.73	1.72	1.375	22.03	11.704	0.056	1.296	0.6755
88	1.75	3.98	2.87	5.475	45.52	25.498	0.032	1.000	0.5155
89	1.68	2.10	1.89	1.875	14.62	8.248	0.034	0.729	0.3813
90	1.68	1.89	1.78	2.875	22.58	12.728	0.028	0.651	0.3393

Table: Resultant average channel one (output) data of modified model

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
1	0.1	0.15	0.15	0.13	0.1	0.1	0.1	0.10	0.002	0.001	0.001	0.001
2	0.1	0.1	0.1	0.10	0.2	0.15	0.1	0.15	0.002	0.001	0.001	0.001
3	0.1	0.1	0.25	0.15	0.45	0.35	0.35	0.38	0.011	0.005	0.015	0.010
4	0.1	0.3	0.7	0.37	0.95	0.65	0.4	0.67	0.016	0.008	0.009	0.011
5	0.35	0.25	0.25	0.28	0.55	0.6	0.45	0.53	0.021	0.010	0.019	0.016
6	0.5	0.15	0.25	0.30	0.6	0.6	0.95	0.72	0.045	0.023	0.022	0.030
7	0.25	0.2	0.3	0.25	0.7	0.75	0.65	0.70	0.042	0.021	0.050	0.037
8	0.3	0.4	0.35	0.35	0.75	0.8	1.15	0.90	0.031	0.016	0.070	0.039
9	0.35	0.25	0.35	0.32	0.6	0.75	1.3	0.88	0.032	0.016	0.071	0.040
10	0.3	0.4	0.25	0.32	0.5	0.7	1.15	0.78	0.039	0.020	0.064	0.041
11	0.3	0.55	0.75	0.53	0.65	0.6	0.8	0.68	0.066	0.033	0.073	0.057
12	0.6	0.65	0.5	0.58	0.75	0.8	1.1	0.88	0.034	0.017	0.068	0.040
13	0.3	0.3	1	0.53	0.65	0.7	0.95	0.77	0.046	0.023	0.057	0.042
14	0.5	0.4	0.45	0.45	0.85	0.95	1.3	1.03	0.039	0.019	0.041	0.033
15	0.4	0.4	0.75	0.52	0.75	1	1.25	1.00	0.020	0.010	0.030	0.020
16	0.3	0.45	0.55	0.43	0.75	0.75	1.55	1.02	0.025	0.012	0.033	0.023
17	0.55	0.55	0.35	0.48	0.7	1.25	2.45	1.47	0.018	0.009	0.041	0.023

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
18	0.5	0.3	1	0.60	0.7	0.7	1.05	0.82	0.023	0.012	0.052	0.029
19	1.3	0.25	1.15	0.90	0.6	0.7	1.5	0.93	0.026	0.013	0.069	0.036
20	1.95	0.45	1.3	1.23	1	0.75	1.1	0.95	0.029	0.015	0.045	0.030
21	0.75	0.55	0.75	0.68	0.6	0.6	1.2	0.80	0.023	0.012	0.029	0.021
22	0.95	1.05	0.55	0.85	0.75	0.9	1.35	1.00	0.024	0.012	0.031	0.022
23	0.8	0.75	0.65	0.73	0.9	1.25	1.25	1.13	0.023	0.012	0.034	0.023
24	0.9	0.55	0.6	0.68	0.8	1.3	1.55	1.22	0.029	0.015	0.032	0.025
25	0.8	0.55	0.75	0.70	1.2	1.2	0.95	1.12	0.027	0.013	0.043	0.028
26	0.5	0.85	1.25	0.87	0.7	0.9	0.8	0.80	0.022	0.011	0.028	0.020
27	0.4	1	1.15	0.85	0.8	0.8	1.1	0.90	0.054	0.027	0.040	0.040
28	0.7	0.55	1	0.75	0.55	0.75	1.15	0.82	0.052	0.026	0.049	0.042
29	0.4	0.95	0.75	0.70	0.7	1.3	1.1	1.03	0.025	0.012	0.024	0.020
30	0.3	0.85	0.8	0.65	0.7	0.9	1.2	0.93	0.050	0.025	0.029	0.035
31	0.55	0.65	0.7	0.63	0.65	0.9	1.2	0.92	0.059	0.030	0.033	0.040
32	0.5	0.55	0.65	0.57	1.2	0.95	1.05	1.07	0.032	0.016	0.033	0.027
33	0.65	0.8	0.4	0.62	1.1	1	0.9	1.00	0.045	0.023	0.031	0.033
34	0.5	0.7	0.35	0.52	0.65	1	1.05	0.90	0.020	0.010	0.031	0.020
35	0.5	0.55	0.35	0.47	0.95	0.8	0.95	0.90	0.041	0.021	0.032	0.031
36	0.7	0.4	0.35	0.48	0.75	0.85	0.8	0.80	0.067	0.033	0.029	0.043
37	0.65	0.3	0.35	0.43	0.8	1.05	0.95	0.93	0.030	0.015	0.027	0.024
38	1	0.45	0.3	0.58	1.5	0.95	1	1.15	0.037	0.018	0.029	0.028
39	0.55	0.55	0.4	0.50	0.95	0.8	0.95	0.90	0.022	0.011	0.034	0.022
40	0.65	0.3	0.3	0.42	0.95	0.8	0.9	0.88	0.020	0.010	0.033	0.021
41	0.55	0.3	0.4	0.42	0.8	0.95	1.1	0.95	0.063	0.031	0.026	0.040
42	0.3	0.25	0.4	0.32	1.15	0.95	0.85	0.98	0.048	0.024	0.033	0.035
43	0.5	0.25	0.25	0.33	1	1.05	1.15	1.07	0.043	0.022	0.029	0.031
44	0.35	0.25	0.25	0.28	1	0.75	0.8	0.85	0.031	0.015	0.028	0.025
45	0.55	0.2	0.3	0.35	0.85	0.8	0.85	0.83	0.026	0.013	0.041	0.026
46	0.35	0.25	0.5	0.37	0.8	0.65	0.9	0.78	0.038	0.019	0.057	0.038
47	0.3	0.3	0.25	0.28	0.7	0.6	1.05	0.78	0.024	0.012	0.061	0.032
48	0.35	0.4	0.25	0.33	1	0.65	1.15	0.93	0.084	0.042	0.038	0.055
49	0.35	0.35	0.3	0.33	0.8	0.45	1.05	0.77	0.058	0.029	0.027	0.038
50	0.45	0.4	0.35	0.40	0.7	0.55	1	0.75	0.046	0.023	0.038	0.035
51	0.35	0.35	0.5	0.40	1.05	0.55	0.75	0.78	0.042	0.021	0.045	0.036
52	0.65	0.4	0.55	0.53	0.85	0.7	0.8	0.78	0.061	0.030	0.037	0.043
53	0.3	0.3	0.4	0.33	0.7	0.6	1	0.77	0.043	0.021	0.021	0.028
54	0.35	0.35	0.45	0.38	0.7	0.7	0.9	0.77	0.060	0.030	0.034	0.041
55	0.3	0.45	0.5	0.42	0.6	0.75	1.05	0.80	0.038	0.019	0.046	0.034

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
56	0.25	0.35	0.5	0.37	0.5	0.55	1.1	0.72	0.045	0.022	0.036	0.034
57	0.2	0.25	0.35	0.27	0.45	0.55	0.75	0.58	0.046	0.023	0.040	0.036
58	0.55	0.25	0.4	0.40	0.35	0.8	0.6	0.58	0.061	0.031	0.033	0.041
59	0.35	0.15	0.55	0.35	0.8	0.7	1.1	0.87	0.040	0.020	0.031	0.030
60	0.4	0.2	0.3	0.30	0.7	0.85	1.4	0.98	0.045	0.022	0.050	0.039
61	0.35	0.2	0.3	0.28	0.7	0.55	0.7	0.65	0.084	0.042	0.047	0.058
62	0.4	0.2	0.45	0.35	0.6	0.6	0.7	0.63	0.032	0.016	0.032	0.026
63	0.35	0.2	0.3	0.28	1.2	0.5	1.1	0.93	0.033	0.016	0.032	0.027
64	0.5	0.15	0.35	0.33	0.7	0.6	0.4	0.57	0.021	0.011	0.025	0.019
65	0.35	0.2	0.35	0.30	1	0.5	0.2	0.57	0.038	0.019	0.029	0.028
66	0.3	0.25	0.35	0.30	0.9	0.45	0.675	0.68	0.042	0.021	0.055	0.039
67	0.2	0.2	0.25	0.22	1	0.5	0.75	0.75	0.031	0.016	0.058	0.035
68	0.15	0.25	0.4	0.27	1.1	0.75	0.925	0.93	0.039	0.020	0.041	0.033
69	0.6	0.25	0.35	0.40	1.2	0.75	0.975	0.98	0.063	0.031	0.035	0.043
70	0.35	0.25	0.4	0.33	2.1	0.6	1.35	1.35	0.045	0.022	0.055	0.040
71	0.2	0.25	0.35	0.27	1.7	0.9	1.3	1.30	0.023	0.012	0.035	0.023
72	0.7	0.25	0.6	0.52	1.4	0.7	1.05	1.05	0.021	0.011	0.016	0.016
73	0.3	0.3	0.75	0.45	1	0.8	0.9	0.90	0.020	0.010	0.010	0.013
74	0.4	0.3	0.45	0.38	1.3	0.7	1	1.00	0.033	0.017	0.013	0.021
75	0.2	0.25	0.5	0.32	1.4	0.9	1.15	1.15	0.016	0.018	0.020	0.018
76	0.8	0.2	0.45	0.48	1.3	0.8	1.05	1.05	0.027	0.023	0.018	0.023
77	0.4	0.2	0.45	0.35	1.4	0.8	1.1	1.10	0.056	0.038	0.020	0.038
78	0.2	0.15	0.45	0.27	1.3	0.5	0.9	0.90	0.064	0.047	0.030	0.047
79	0.6	0.35	0.35	0.43	0.8	0.6	0.7	0.70	0.030	0.026	0.021	0.026
80	0.3	0.35	0.45	0.37	0.7	0.9	0.8	0.80	0.023	0.019	0.014	0.019
81	0.3	0.5	0.3	0.37	0.6	0.8	0.7	0.70	0.015	0.009	0.002	0.009
82	0.7	0.4	0.3	0.47	0.8	0.7	0.75	0.75	0.003	0.002	0.001	0.002
83	0.4	0.45	0.3	0.38	0.5	0.3	0.4	0.40	0.001	0.001	0.001	0.001

Table: Resultant average channel two (input I) data of modified model

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
1	0.1	0.05	0.25	0.13	0.1	0.15	0.1	0.12	0.003	0.019	0.006	0.009
2	0.15	0.05	0.15	0.12	0.4	6.15	0.7	2.42	0.006	0.056	0.022	0.028
3	0.35	0.5	1.3	0.72	5.5	9.55	7	7.35	0.307	0.546	0.518	0.457
4	1.15	0.5	1.45	1.03	15.5	10.75	9	11.75	0.460	0.834	0.493	0.595

	Acceleration (m/s²)				**velocity (mm/s)**				**Displacement (P-P) mm**			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
5	1.25	0.6	2.05	1.30	5.9	22.25	12.85	13.67	0.504	1.094	1.027	0.875
6	3.3	1.6	3.5	2.80	9.5	12.45	9.2	10.38	0.920	0.960	1.174	1.018
7	1.65	2.5	2.75	2.30	16.85	26.5	14.2	19.18	0.747	1.596	0.971	1.104
8	1.9	1.85	2.4	2.05	12.1	27.5	29.5	23.03	0.710	1.285	0.541	0.845
9	3.5	1.7	2.6	2.60	15	20.55	34	23.18	0.858	1.347	0.750	0.985
10	2	2	3.1	2.37	15	16.65	15.5	15.72	1.215	0.049	1.689	0.984
11	3.6	3.1	5.2	3.97	15.35	31.25	22.35	22.98	1.264	1.656	0.649	1.189
12	3.25	2.85	1.95	2.68	17	20.05	25.7	20.92	1.033	1.694	0.886	1.204
13	1.65	1.5	5.9	3.02	16	27.4	24.15	22.52	1.338	1.465	0.425	1.076
14	3.35	2.35	2.15	2.62	15.95	34.95	32	27.63	0.766	1.069	0.597	0.810
15	2.75	1.85	3.05	2.55	15.75	31.2	40.85	29.27	0.566	1.233	1.521	1.106
16	2.5	3.3	3.6	3.13	12.65	22.6	61.4	32.22	0.645	0.750	1.231	0.875
17	3.25	2.8	2.65	2.90	10.6	33.35	43.9	29.28	0.716	0.999	0.632	0.782
18	3.1	1.75	5.25	3.37	17.35	28.35	64.95	36.88	0.644	0.714	0.509	0.622
19	4.35	2.35	6.2	4.30	23.55	32.95	33.6	30.03	1.198	0.493	0.784	0.825
20	6.35	2.85	7.3	5.50	20.25	16.65	23.8	20.23	0.986	0.854	0.529	0.789
21	7.75	2.35	4.9	5.00	16.5	16.65	27.7	20.28	0.908	1.234	1.022	1.054
22	4.8	3.2	5	4.33	16.65	42.75	31.2	30.20	0.870	0.842	1.058	0.923
23	7.65	3.3	4.35	5.10	21.25	41.7	55.55	39.50	0.767	0.922	1.143	0.944
24	4.45	3.65	4.65	4.25	30.25	55.6	38.9	41.58	0.936	0.978	0.854	0.922
25	5.4	3.1	3.95	4.15	31	29.75	29.35	30.03	1.009	1.200	1.058	1.089
26	3.85	3.8	5.15	4.27	28.5	27.75	29.15	28.47	0.613	0.782	0.833	0.742
27	3.15	5.65	5.25	4.68	13.45	29.7	43.55	28.90	1.150	0.890	1.498	1.179
28	3.3	3.8	4.5	3.87	14	28.3	44.85	29.05	1.040	1.068	1.070	1.059
29	3.3	4.7	5	4.33	20.3	33.65	26.9	26.95	0.872	0.944	0.828	0.881
30	2.2	3.75	3.35	3.10	15.8	24.5	28.3	22.87	1.151	0.704	0.936	0.930
31	2.7	3.1	3.65	3.15	16.45	24.95	43.1	28.17	0.852	0.790	1.384	1.009
32	2.55	4.7	3.5	3.58	30.95	19.55	29.1	26.53	0.678	1.060	0.953	0.897
33	3.6	4.2	2.45	3.42	24.2	27.35	32.65	28.07	0.850	1.024	1.165	1.013
34	2.5	5.5	3	3.67	20.8	25.2	14.35	20.12	0.527	0.729	1.170	0.809
35	2.6	2.9	3.4	2.97	20.2	30.4	22.1	24.23	0.966	0.822	1.110	0.966
36	4.15	2.8	1.5	2.82	20.55	25.4	19.1	21.68	1.222	0.922	1.081	1.075
37	3.8	3.65	2.35	3.27	27.3	33.7	20.15	27.05	0.594	0.589	0.876	0.686
38	4.1	2.9	2.45	3.15	31.05	30.2	34.15	31.80	1.072	0.870	0.961	0.967
39	4.6	4.6	2	3.73	23.3	23.65	30.9	25.95	0.625	0.737	1.226	0.862
40	2.95	2.35	1.75	2.35	20.1	19.7	22.1	20.63	0.687	1.066	1.124	0.959
41	2.7	2.45	2.5	2.55	24.4	18.7	30.15	24.42	0.674	0.876	1.112	0.887
42	1.9	1.85	2.2	1.98	20.3	18.65	20	19.65	1.463	0.835	0.999	1.099

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
43	1.85	1.65	1.55	1.68	21.05	49.55	35.15	35.25	0.141	0.876	0.891	0.636
44	2.55	1.9	2.15	2.20	23.25	20.15	21.95	21.78	0.006	1.163	0.973	0.714
45	3.85	1.8	2.15	2.60	35.1	28.95	16.7	26.92	0.695	1.177	1.180	1.017
46	3.05	2.25	2.15	2.48	28.35	23.05	26.55	25.98	1.525	1.504	0.667	1.232
47	2.05	2	1.9	1.98	28.35	17.25	24	23.20	0.746	0.081	0.051	0.293
48	1.45	2.9	2.1	2.15	50.9	28.65	36.15	38.57	0.412	0.765	1.459	0.878
49	2.1	2.45	3.1	2.55	26.95	15.8	26.25	23.00	1.263	0.972	0.808	1.014
50	1.7	1.65	3.05	2.13	21.95	13.25	21.45	18.88	1.440	1.274	0.031	0.915
51	2.05	2.75	2.4	2.40	36.9	17.55	23.65	26.03	1.403	1.174	1.557	1.378
52	2.2	2.3	4.1	2.87	17.15	16.8	20.1	18.02	0.870	1.029	0.842	0.913
53	1.8	1.55	2.95	2.10	17.95	15.8	20.25	18.00	1.171	1.040	0.864	1.025
54	2.65	1.9	2.1	2.22	14.4	15.5	21.6	17.17	1.528	1.016	1.167	1.237
55	2.2	2.55	2.7	2.48	14.75	30	29.4	24.72	0.961	0.942	0.472	0.791
56	1.95	2.15	2.1	2.07	17.15	14.8	35.75	22.57	1.299	0.869	0.612	0.926
57	1.15	3.75	1.45	2.12	7.75	27.75	19.6	18.37	1.433	0.743	0.486	0.887
58	1.2	2.4	1.8	1.80	6.8	19.7	17.35	14.62	1.367	1.264	1.199	1.276
59	1.5	2.2	1.65	1.78	12.3	29.4	25.8	22.50	1.254	0.049	1.255	0.853
60	1.5	1.95	2.05	1.83	21.2	20.65	47.4	29.75	1.079	1.180	1.369	1.209
61	2.05	1.9	2.1	2.02	11.2	18.4	19.2	16.27	0.069	0.272	0.963	0.435
62	2.1	2.35	2.25	2.23	10.2	18.9	15.7	14.93	1.240	1.006	0.281	0.842
63	2.3	2.1	2.1	2.17	15.6	19.15	43.8	26.18	0.938	1.140	0.857	0.978
64	2	2.05	2.55	2.20	17.4	21.45	7.4	15.42	0.791	0.128	0.749	0.556
65	2.15	1.65	2.05	1.95	11.7	10.75	2	8.15	1.000	0.985	1.032	1.006
66	2.1	1.9	1.9	1.97	13.5	9.8	11.65	11.65	1.550	1.000	1.603	1.384
67	1.35	1.9	2	1.75	69.6	13	41.3	41.30	0.237	1.672	1.489	1.133
68	0.85	1.9	2.45	1.73	18.5	19.5	19	19.00	1.687	0.496	0.021	0.735
69	0.8	1.6	2.1	1.50	27.3	11.2	19.25	19.25	1.000	1.526	0.997	1.174
70	0.8	1.75	2.7	1.75	28.5	10.9	19.7	19.70	1.713	0.974	1.000	1.229
71	0.9	1.7	2.65	1.75	34.6	39.1	36.85	36.85	0.853	1.637	0.968	1.153
72	1.5	2.05	2.8	2.12	22.6	13.5	18.05	18.05	0.984	1.100	0.947	1.010
73	1.1	1.8	4.35	2.42	22.2	21.8	22	22.00	0.525	0.082	0.537	0.381
74	1.2	3.15	2.4	2.25	42.1	15.9	29	29.00	1.000	0.013	0.511	0.508
75	1.5	1.8	2.8	2.03	43.7	31	37.35	37.35	0.823	0.920	1.016	0.920
76	0.6	2.15	2.8	1.85	25.7	24.4	25.05	25.05	0.449	0.702	0.954	0.702
77	1	1.65	3.15	1.93	16.1	37.9	27	27.00	1.348	1.367	1.385	1.367
78	1.6	1.7	3.05	2.12	46.3	10.2	28.25	28.25	1.000	1.157	1.314	1.157
79	1.8	1.7	2.75	2.08	22.4	20.3	21.35	21.35	1.689	1.364	1.038	1.364
80	1.7	2.35	1.35	1.80	21.2	27	24.1	24.10	0.686	0.677	0.667	0.677

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
81	1.3	2.8	1.35	1.82	17.6	26.7	22.15	22.15	0.641	0.365	0.089	0.365
82	2.5	2.3	1.5	2.10	23.2	16.7	19.95	19.95	0.186	0.106	0.025	0.106
83	2.5	1.8	2.5	2.27	20.7	1.7	11.2	11.20	0.051	0.029	0.006	0.029

Table: Resultant average channel three (input II) data of modified model

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
1	0.15	0.1	0.3	0.18	0.15	0.15	0.1	0.13	0.010	0.035	0.014	0.020
2	0.15	0.1	0.15	0.13	0.55	8.55	1.15	3.42	0.012	0.060	0.045	0.039
3	0.3	0.7	1.5	0.83	6.55	9.15	7.45	7.72	0.311	0.468	0.471	0.416
4	1.1	0.55	1.45	1.03	10.9	13.4	11.7	12.00	0.608	0.562	0.441	0.537
5	1.4	0.65	2.65	1.57	5.9	21.95	12.85	13.57	0.785	0.825	0.725	0.778
6	3.05	1.55	3.5	2.70	9.8	16.5	29.55	18.62	0.720	1.293	1.142	1.051
7	2.5	2.7	2.75	2.65	14.6	27.35	20	20.65	1.020	1.379	0.961	1.120
8	2.5	2.05	2.8	2.45	19.25	29.25	61.55	36.68	0.708	1.456	1.000	1.054
9	6.55	2.1	2.95	3.87	15.15	21.25	33.2	23.20	1.318	1.397	0.641	1.119
10	2.8	2.85	3.5	3.05	14.3	20.25	43.35	25.97	1.271	0.918	1.630	1.273
11	3.45	3.1	5	3.85	15.9	18.75	23.8	19.48	1.312	1.715	1.000	1.342
12	2.85	3.7	2.3	2.95	16.5	21.95	26.15	21.53	1.157	0.101	0.812	0.690
13	1.55	1.6	2.25	1.80	18.85	25.25	32.05	25.38	1.651	1.483	0.455	1.196
14	8.35	2.75	2.8	4.63	15.45	38.15	54.65	36.08	1.068	1.657	0.619	1.115
15	3.55	2.1	3.35	3.00	14.95	39.15	34.5	29.53	0.617	1.472	0.609	0.899
16	3.35	3.05	5.15	3.85	12.85	27.3	31.65	23.93	0.744	0.668	1.297	0.903
17	3.2	3.1	3.3	3.20	7.3	33.2	55.9	32.13	0.860	1.184	0.753	0.932
18	3.35	1.95	3.95	3.08	17.45	22.55	35.85	25.28	0.859	0.604	0.453	0.639
19	8.8	2.35	7.15	6.10	25.3	26.35	69.65	40.43	1.118	0.636	0.833	0.862
20	5.95	4.6	6.1	5.55	30.75	28.6	35.75	31.70	0.970	1.143	0.637	0.917
21	6.4	2.3	8.55	5.75	18.2	22.75	24.05	21.67	0.834	0.837	1.084	0.918
22	8.3	5.85	5.65	6.60	17.4	43.25	31.15	30.60	0.756	0.855	0.464	0.692
23	6.1	3.4	5	4.83	31.75	37.55	37.15	35.48	0.716	0.074	1.139	0.643
24	5.95	3.2	5.35	4.83	28.15	55.95	40.55	41.55	1.101	1.152	0.999	1.084
25	5.15	3.15	5.7	4.67	27.35	34.5	25.7	29.18	0.862	1.246	0.973	1.027
26	7.35	3.3	6.75	5.80	25.55	25.05	24.9	25.17	0.875	0.826	1.093	0.931
27	3.65	6.9	8.45	6.33	20.65	26.9	39.35	28.97	1.148	1.128	0.807	1.028
28	4.3	3.9	6	4.73	13.4	31.25	35.35	26.67	1.458	0.878	0.446	0.927

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	AVG a	day 1	day 2	day 3	AVG V	day 1	day 2	day 3	AVG dis
29	4	4.8	5	4.60	17.95	29.95	39.95	29.28	0.806	1.150	0.706	0.887
30	2.1	3.3	6.6	4.00	12.85	19.25	30	20.70	1.353	0.930	0.959	1.081
31	2.85	2.75	3.9	3.17	18.85	28.7	23.15	23.57	0.933	0.782	1.159	0.958
32	2.95	4.25	2.95	3.38	36.05	34.45	32.9	34.47	0.899	1.028	1.160	1.029
33	2.9	3.9	2.65	3.15	33.45	36.85	26.6	32.30	1.047	0.770	1.016	0.944
34	2.8	5	3.75	3.85	23.45	26.65	19.25	23.12	0.639	0.629	1.089	0.785
35	2.8	3.2	3.75	3.25	17.95	34.5	14.1	22.18	1.362	0.891	1.327	1.193
36	3.65	2.4	1.8	2.62	19.4	60.3	20.8	33.50	1.450	0.020	0.987	0.819
37	3.35	3.35	2.75	3.15	26.75	32	28.45	29.07	0.634	0.654	0.857	0.715
38	5.4	2.9	2.65	3.65	28.1	16	31.15	25.08	1.041	0.741	0.891	0.891
39	4.35	5.15	2.7	4.07	19.15	27	29.9	25.35	0.748	0.605	1.120	0.824
40	3.8	3.1	1.75	2.88	19.5	18.5	17	18.33	0.772	0.930	0.896	0.866
41	2.35	2.75	2.35	2.48	18.75	52.1	35.05	35.30	0.794	0.890	0.918	0.867
42	1.95	1.9	2.25	2.03	34.3	19.75	38.7	30.92	0.194	0.800	1.044	0.679
43	2.55	1.55	1.65	1.92	27.25	38.15	44.8	36.73	0.156	1.104	1.158	0.806
44	2.6	2.2	2.6	2.47	30.45	26.5	19.25	25.40	1.157	1.424	0.961	1.181
45	3.3	1.95	1.9	2.38	22.1	20.9	24.35	22.45	0.741	1.170	1.445	1.118
46	3.1	3.35	1.9	2.78	15.05	17.2	26	19.42	1.345	1.276	1.242	1.287
47	2.4	2.45	2.05	2.30	26.1	18.9	19.7	21.57	0.799	0.174	0.033	0.335
48	1.6	3.85	2.05	2.50	23.1	19.95	36.05	26.37	1.000	0.881	1.269	1.050
49	2	3.1	2.85	2.65	19.9	15.95	38.2	24.68	1.194	0.969	0.756	0.973
50	2	1.85	3.7	2.52	24.25	15.05	26.75	22.02	1.577	0.844	1.433	1.285
51	2.7	3.65	3.3	3.22	52.4	19.95	22.8	31.72	1.227	1.304	1.380	1.304
52	2.95	2.1	3.2	2.75	14.95	28.55	19.3	20.93	0.059	0.929	1.062	0.683
53	2	2.1	3.55	2.55	14.75	21.35	31.35	22.48	1.242	0.915	0.886	1.014
54	2.55	2.5	2.35	2.47	13.5	19.5	19.9	17.63	1.802	1.077	1.150	1.343
55	1.95	2.9	2.85	2.57	13.8	26.3	37.1	25.73	0.970	0.750	0.657	0.792
56	2	2.15	2.1	2.08	19.5	15.2	19	17.90	1.358	0.732	0.401	0.830
57	1.3	3.7	1.95	2.32	9	22.55	16.65	16.07	1.497	0.637	0.446	0.860
58	1.15	2.05	2.25	1.82	6.75	16.2	14.6	12.52	0.914	0.745	1.159	0.939
59	1.5	2.55	1.9	1.98	19.3	21.7	33.3	24.77	1.469	0.893	1.404	1.255
60	1.7	2.1	1.6	1.80	17.3	28.9	37.5	27.90	1.336	1.577	0.982	1.298
61	1.75	2.2	2.2	2.05	13.2	14.8	21	16.33	1.000	1.000	1.027	1.009
62	2.05	1.85	2.05	1.98	14.4	25.3	10.4	16.70	1.333	1.374	0.378	1.028
63	2.25	1.9	2.1	2.08	14.1	12.45	31.3	19.28	1.208	1.295	0.910	1.138
64	2.45	2.1	2.3	2.28	15.4	30.6	9.8	18.60	0.771	1.000	0.866	0.879
65	2.1	1.8	2.45	2.12	9.9	16.4	1.6	9.30	1.475	1.657	1.406	1.512
66	2.65	1.95	1.6	2.07	13.1	10.35	11.725	11.73	1.684	0.254	0.275	0.738

	Acceleration (m/s²)				velocity (mm/s)				Displacement (P-P) mm			
SL.	day 1	day 2	day 3	**AVG a**	day 1	day 2	day 3	**AVG V**	day 1	day 2	day 3	**AVG dis**
67	1.7	2.45	1.6	1.92	28.9	16	22.45	22.45	1.633	1.000	0.620	1.084
68	2	1.95	1.85	1.93	10.3	33.2	21.75	21.75	1.435	1.000	1.134	1.190
69	1.25	1.85	2	1.70	26.2	26.6	26.4	26.40	1.000	1.718	0.732	1.150
70	1.05	1.85	2.5	1.80	19.9	13.4	16.65	16.65	1.477	1.100	0.889	1.155
71	1.2	2.25	2.65	2.03	20.7	32.3	26.5	26.50	1.472	1.504	1.187	1.388
72	1.7	1.9	2.4	2.00	36.5	19.8	28.15	28.15	0.940	1.141	0.935	1.005
73	1.5	2.1	3.2	2.27	23.4	21.1	22.25	22.25	0.924	0.061	0.640	0.542
74	2	2.3	2.7	2.33	90	17.8	53.9	53.90	1.264	0.030	0.733	0.676
75	1.5	2.4	2.55	2.15	35.7	37.9	36.8	36.80	0.773	0.924	1.074	0.924
76	0.8	1.85	2.5	1.72	38.7	23.2	30.95	30.95	0.959	0.977	0.995	0.977
77	1.1	1.55	2.8	1.82	16.8	17	16.9	16.90	1.346	1.332	1.317	1.332
78	1.2	1.65	2.7	1.85	25	8.9	16.95	16.95	1.870	1.685	1.500	1.685
79	1.7	1.8	2.3	1.93	22.5	15.7	19.1	19.10	1.132	1.000	0.868	1.000
80	2.2	2.35	1.15	1.90	27.6	17.6	22.6	22.60	0.732	0.809	0.885	0.809
81	2.1	2.5	1.45	2.02	34.9	27.1	31	31.00	0.665	0.389	0.113	0.389
82	3.1	2.3	1.9	2.43	34.6	17.9	26.25	26.25	0.338	0.185	0.031	0.185
83	3.8	1.7	1.8	2.43	21.3	1.9	11.6	11.60	0.041	0.026	0.010	0.026
84	2.1	1.65	2	1.92	15.2	15.4	15.3	15.30	0.041	0.025	0.009	0.025
85	3.6	1.8	2	2.47	28.6	28.8	28.7	28.70	0.041	0.025	0.009	0.025
86	1.8	1.95	3.5	2.42	15	15.2	15.1	15.10	0.041	0.025	0.008	0.025
87	2.1	2.6	2.5	2.40	11.9	12.1	12	12.00	0.041	0.026	0.010	0.026

Table: Resultant average input data of modified model

	Acceleration (m/s²)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
1	0.13	0.18	0.16	5.00	3.50	4.25	0.01	0.02	0.0143
2	0.12	0.13	0.13	2.42	3.42	2.92	0.03	0.04	0.0336
3	0.72	0.83	0.78	7.35	7.72	7.53	0.46	0.42	0.4368
4	1.03	1.03	1.03	11.75	12.00	11.88	0.60	0.54	0.5662
5	1.30	1.57	1.43	13.67	13.57	13.62	0.87	0.78	0.8265
6	2.80	2.70	2.75	10.38	18.62	14.50	1.02	1.05	1.0345
7	2.30	2.65	2.48	19.18	20.65	19.92	1.10	1.12	1.1120
8	2.05	2.45	2.25	23.03	36.68	29.86	0.85	1.05	0.9497
9	2.60	3.87	3.23	23.18	23.20	23.19	0.98	1.12	1.0517
10	2.37	3.05	2.71	15.72	25.97	20.84	0.98	1.27	1.1284
11	3.97	3.85	3.91	22.98	19.48	21.23	1.19	1.34	1.2657

	Acceleration (m/s^2)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
12	2.68	2.95	2.82	20.92	21.53	21.23	1.20	0.69	0.9471
13	3.02	1.80	2.41	22.52	25.38	23.95	1.08	1.20	1.1360
14	2.62	4.63	3.63	27.63	36.08	31.86	0.81	1.11	0.9625
15	2.55	3.00	2.78	29.27	29.53	29.40	1.11	0.90	1.0029
16	3.13	3.85	3.49	32.22	23.93	28.08	0.88	0.90	0.8891
17	2.90	3.20	3.05	29.28	32.13	30.71	0.78	0.93	0.8573
18	3.37	3.08	3.23	36.88	25.28	31.08	0.62	0.64	0.6303
19	4.30	6.10	5.20	30.03	40.43	35.23	0.82	0.86	0.8436
20	5.50	5.55	5.53	20.23	31.70	25.97	0.79	0.92	0.8531
21	5.00	5.75	5.38	20.28	21.67	20.98	1.05	0.92	0.9861
22	4.33	6.60	5.47	30.20	30.60	30.40	0.92	0.69	0.8074
23	5.10	4.83	4.97	39.50	35.48	37.49	0.94	0.64	0.7933
24	4.25	4.83	4.54	41.58	41.55	41.57	0.92	1.08	1.0031
25	4.15	4.67	4.41	30.03	29.18	29.61	1.09	1.03	1.0577
26	4.27	5.80	5.03	28.47	25.17	26.82	0.74	0.93	0.8367
27	4.68	6.33	5.51	28.90	28.97	28.93	1.18	1.03	1.1033
28	3.87	4.73	4.30	29.05	26.67	27.86	1.06	0.93	0.9932
29	4.33	4.60	4.47	26.95	29.28	28.12	0.88	0.89	0.8843
30	3.10	4.00	3.55	22.87	20.70	21.78	0.93	1.08	1.0053
31	3.15	3.17	3.16	28.17	23.57	25.87	1.01	0.96	0.9832
32	3.58	3.38	3.48	26.53	34.47	30.50	0.90	1.03	0.9629
33	3.42	3.15	3.28	28.07	32.30	30.18	1.01	0.94	0.9786
34	3.67	3.85	3.76	20.12	23.12	21.62	0.81	0.79	0.7969
35	2.97	3.25	3.11	24.23	22.18	23.21	0.97	1.19	1.0796
36	2.82	2.62	2.72	21.68	33.50	27.59	1.07	0.82	0.9467
37	3.27	3.15	3.21	27.05	29.07	28.06	0.69	0.71	0.7005
38	3.15	3.65	3.40	31.80	25.08	28.44	0.97	0.89	0.9291
39	3.73	4.07	3.90	25.95	25.35	25.65	0.86	0.82	0.8433
40	2.35	2.88	2.62	20.63	18.33	19.48	0.96	0.87	0.9123
41	2.55	2.48	2.52	24.42	35.30	29.86	0.89	0.87	0.8771
42	1.98	2.03	2.01	19.65	30.92	25.28	1.10	0.68	0.8890
43	1.68	1.92	1.80	35.25	36.73	35.99	0.64	0.81	0.7210
44	2.20	2.47	2.33	21.78	25.40	23.59	0.71	1.18	0.9473
45	2.60	2.38	2.49	26.92	22.45	24.68	1.02	1.12	1.0677
46	2.48	2.78	2.63	25.98	19.42	22.70	1.23	1.29	1.2594
47	1.98	2.30	2.14	23.20	21.57	22.38	0.29	0.34	0.3139
48	2.15	2.50	2.33	38.57	26.37	32.47	0.88	1.05	0.9641
49	2.55	2.65	2.60	23.00	24.68	23.84	1.01	0.97	0.9934

	Acceleration (m/s^2)			velocity (mm/s)			Displacement (P-P) mm		
SL.	Channel 2	Channel 3	**Input a**	Channel 2	Channel 3	**Input V**	Channel 2	Channel 3	**Input dis**
50	2.13	2.52	2.33	18.88	22.02	20.45	0.91	1.28	1.0998
51	2.40	3.22	2.81	26.03	31.72	28.88	1.38	1.30	1.3407
52	2.87	2.75	2.81	18.02	20.93	19.48	0.91	0.68	0.7983
53	2.10	2.55	2.33	18.00	22.48	20.24	1.03	1.01	1.0196
54	2.22	2.47	2.34	17.17	17.63	17.40	1.24	1.34	1.2900
55	2.48	2.57	2.53	24.72	25.73	25.23	0.79	0.79	0.7917
56	2.07	2.08	2.08	22.57	17.90	20.23	0.93	0.83	0.8782
57	2.12	2.32	2.22	18.37	16.07	17.22	0.89	0.86	0.8736
58	1.80	1.82	1.81	14.62	12.52	13.57	1.28	0.94	1.1077
59	1.78	1.98	1.88	22.50	24.77	23.63	0.85	1.26	1.0538
60	1.83	1.80	1.82	29.75	27.90	28.83	1.21	1.30	1.2537
61	2.02	2.05	2.03	16.27	16.33	16.30	0.43	1.01	0.7219
62	2.23	1.98	2.11	14.93	16.70	15.82	0.84	1.03	0.9352
63	2.17	2.08	2.13	26.18	19.28	22.73	0.98	1.14	1.0579
64	2.20	2.28	2.24	15.42	18.60	17.01	0.56	0.88	0.7173
65	1.95	2.12	2.03	8.15	9.30	8.73	1.01	1.51	1.2589
66	1.97	2.07	2.02	11.65	11.73	11.69	1.38	0.74	1.0609
67	1.75	1.92	1.83	41.30	22.45	31.88	1.13	1.08	1.1084
68	1.73	1.93	1.83	19.00	21.75	20.38	0.73	1.19	0.9622
69	1.50	1.70	1.60	19.25	26.40	22.83	1.17	1.15	1.1620
70	1.75	1.80	1.78	19.70	16.65	18.18	1.23	1.16	1.1919
71	1.75	2.03	1.89	36.85	26.50	31.68	1.15	1.39	1.2700
72	2.12	2.00	2.06	18.05	28.15	23.10	1.01	1.01	1.0077
73	2.42	2.27	2.34	22.00	22.25	22.13	0.38	0.54	0.4614
74	2.25	2.33	2.29	29.00	53.90	41.45	0.51	0.68	0.5918
75	2.03	2.15	2.09	37.35	36.80	37.08	0.92	0.92	0.9215
76	1.85	1.72	1.78	25.05	30.95	28.00	0.70	0.98	0.8393
77	1.93	1.82	1.88	27.00	16.90	21.95	1.37	1.33	1.3490
78	2.12	1.85	1.98	28.25	16.95	22.60	1.16	1.69	1.4210
79	2.08	1.93	2.01	21.35	19.10	20.23	1.36	1.00	1.1818
80	1.80	1.90	1.85	24.10	22.60	23.35	0.68	0.81	0.7425
81	1.82	2.02	1.92	22.15	31.00	26.58	0.37	0.39	0.3770
82	2.10	2.43	2.27	19.95	26.25	23.10	0.11	0.18	0.1450
83	2.27	2.43	2.35	11.20	11.60	11.40	0.03	0.03	0.0270
84	1.90	1.92	1.91	22.98	15.30	19.14	0.03	0.03	0.0258
85	1.95	2.47	2.21	21.28	28.70	24.99	0.03	0.03	0.0258
86	2.00	2.42	2.21	12.18	15.10	13.64	0.03	0.02	0.0253
87	2.15	2.40	2.28	12.18	12.00	12.09	0.03	0.03	0.0268

Table: Resultant response ratio for both model

SL	Response of conventional model			Response of modified model		
	output response	Input response	response ratio	output response	Input response	response ratio
1	1.20	2.08	0.578	0.133	2.000	0.067
2	1.28	1.88	0.681	0.100	1.500	0.067
3	1.38	3.00	0.461	0.150	0.775	0.194
4	1.17	2.64	0.442	0.367	1.033	0.355
5	1.15	1.87	0.616	0.283	1.433	0.198
6	1.40	2.18	0.641	0.300	2.750	0.109
7	1.33	2.21	0.604	0.250	2.475	0.101
8	1.68	3.63	0.463	0.350	2.250	0.156
9	4.03	6.74	0.598	0.317	3.233	0.098
10	1.87	2.84	0.657	0.317	2.708	0.117
11	1.43	2.61	0.550	0.533	3.908	0.136
12	1.43	2.83	0.506	0.583	2.817	0.207
13	1.53	3.36	0.457	0.533	2.408	0.221
14	1.38	2.72	0.509	0.450	3.625	0.124
15	1.40	2.91	0.481	0.517	2.775	0.186
16	1.43	2.38	0.601	0.433	3.492	0.124
17	1.37	2.18	0.626	0.483	3.050	0.158
18	1.52	2.43	0.625	0.600	3.225	0.186
19	1.35	2.21	0.611	0.900	5.200	0.173
20	1.28	2.11	0.609	1.233	5.525	0.223
21	1.33	2.07	0.645	0.683	5.375	0.127
22	1.37	2.17	0.631	0.850	5.467	0.155
23	1.57	2.32	0.676	0.733	4.967	0.148
24	1.40	2.18	0.641	0.683	4.542	0.150
25	1.37	1.98	0.689	0.700	4.408	0.159
26	1.22	1.72	0.709	0.867	5.033	0.172
27	1.10	1.78	0.620	0.850	5.508	0.154
28	1.18	2.13	0.557	0.750	4.300	0.174
29	1.23	1.93	0.641	0.700	4.467	0.157
30	1.12	1.81	0.618	0.650	3.550	0.183
31	1.18	1.87	0.634	0.633	3.158	0.201
32	1.10	2.05	0.537	0.567	3.483	0.163
33	1.22	1.74	0.699	0.617	3.283	0.188
34	1.18	1.82	0.651	0.517	3.758	0.137
35	1.23	1.81	0.682	0.467	3.108	0.150

	Response of conventional model			Response of modified model		
SL	output response	Input response	response ratio	output response	Input response	response ratio
36	1.28	1.98	0.650	0.483	2.717	0.178
37	1.22	2.01	0.606	0.433	3.208	0.135
38	1.17	1.82	0.642	0.583	3.400	0.172
39	1.17	1.68	0.697	0.500	3.900	0.128
40	1.23	1.92	0.643	0.417	2.617	0.159
41	0.98	1.41	0.698	0.417	2.517	0.166
42	1.10	1.58	0.698	0.317	2.008	0.158
43	1.08	1.54	0.703	0.333	1.800	0.185
44	1.22	1.68	0.723	0.283	2.333	0.121
45	1.38	1.66	0.834	0.350	2.492	0.140
46	0.90	1.44	0.624	0.367	2.633	0.139
47	1.12	1.78	0.629	0.283	2.142	0.132
48	1.13	1.84	0.615	0.333	2.325	0.143
49	1.03	1.64	0.629	0.333	2.600	0.128
50	1.08	1.52	0.714	0.400	2.325	0.172
51	0.98	1.51	0.652	0.400	2.808	0.142
52	0.90	1.61	0.560	0.533	2.808	0.190
53	0.92	1.43	0.643	0.333	2.325	0.143
54	0.75	1.14	0.657	0.383	2.342	0.164
55	0.80	1.26	0.636	0.417	2.525	0.165
56	0.85	1.23	0.689	0.367	2.075	0.177
57	0.88	1.41	0.627	0.267	2.217	0.120
58	0.87	1.58	0.550	0.400	1.808	0.221
59	1.03	1.68	0.617	0.350	1.883	0.186
60	0.97	1.68	0.574	0.300	1.817	0.165
61	0.93	1.43	0.655	0.283	2.033	0.139
62	1.08	1.53	0.710	0.350	2.108	0.166
63	0.98	1.68	0.584	0.283	2.125	0.133
64	1.03	1.69	0.611	0.333	2.242	0.149
65	1.03	1.68	0.617	0.300	2.033	0.148
66	1.07	1.75	0.610	0.300	2.017	0.149
67	1.03	1.80	0.574	0.217	1.833	0.118
68	1.10	1.74	0.634	0.267	1.833	0.145
69	1.05	1.79	0.586	0.400	1.600	0.250
70	1.15	1.91	0.603	0.333	1.775	0.188
71	1.02	1.76	0.578	0.267	1.892	0.141
72	1.15	1.86	0.617	0.517	2.058	0.251
73	0.98	1.73	0.568	0.450	2.342	0.192

SL	Response of conventional model			Response of modified model		
	output response	Input response	response ratio	output response	Input response	response ratio
74	0.97	1.66	0.581	0.383	2.292	0.167
75	1.08	1.98	0.546	0.317	2.092	0.151
76	1.22	2.01	0.605	0.483	1.783	0.271
77	1.03	1.94	0.534	0.350	1.875	0.187
78	1.18	1.84	0.642	0.267	1.983	0.134
79	1.23	1.61	0.764	0.433	2.008	0.216
80	1.40	2.30	0.609	0.367	1.850	0.198
81	0.92	1.61	0.569	0.367	1.917	0.191
82	1.40	1.74	0.803	0.467	2.267	0.206
83	1.20	1.92	0.627	0.383	2.350	0.163
84	0.95	1.92	0.494	0.567	1.908	0.297
85	1.00	1.70	0.588	0.417	2.208	0.189
86	1.05	1.63	0.646	0.333	2.208	0.151
87	1.15	1.72	0.671	0.350	2.275	0.154
88	1.30	2.87	0.454	0.467	2.317	0.201
89	1.05	1.89	0.556	0.367	2.083	0.176
90	1.15	1.78	0.645	0.250	1.850	0.135
91	1.50	2.16	0.693	0.233	1.350	0.173
92	2.30	2.31	0.996	0.250	1.092	0.229