CHRIST COLLEGE OF ENGINEERING, IRINJALAKUDA

DEPARTMENT OF MECHANICAL ENGINEERING

RESEARCH BULLETIN

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HOD's Message

With the release of the fourth edition of Department of Mechanical Engineering Research Bulletin, We are showcasing our department's capability in developing innovative technologies applicable to various fields of engineering to a knowledgeable audience. The primary purpose of our research bulletin is to share the research endeavors of our students and faculty members. This initiative will create opportunities for our aspiring engineers to collaborate on emerging topics, ultimately leading to significant advancements in the future. Additionally, it is intended to inspire our junior students to aspire to greater achievements during their time of study.

Prof. (Dr.) SIJO M T

VISION

- To become a nationally recognised knowledge hub in Mechanical Engineering by moulding professionally competent and socially responsible engineers.

MISSION

- To create a conducive learning platform for students to excel as professionals, through quality technical education and training.
- To involve students in socially committed projects and programs to broaden their knowledge and integrity.
- To mould students with good leadership qualities, ethical values, and life-long learning.

PROGRAMME SPECIFIC OUTCOMES (PSO)

- Apply the knowledge of thermal sciences, mechanical design, and manufacturing principles for analysing and evaluating problems in the domain of Mechanical Engineering.
- Apply the knowledge gained through multidisciplinary learning, to solve real life problems.
- Effectively use modern technology tools such as CFD, CAD/CAM and 3-D printing in Mechanical Engineering practice.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- Apply technical knowledge and skills to find feasible solutions in Mechanical Engineering domains and allied industries.
- Evolve as responsible professionals capable of solving socially relevant problems and pursue higher education and research.
- Exhibit professionalism, team work, and ethical attitude through continued learning to accomplish organisational goals.

IMPROVING THE PERFORMANCE OF THE THERMAL RADIATOR

Team Members- Akshai T Raphal, Aravind C S, Edwin Bento, Nikhil S

Guided by - Dr. Viswanath K Kaimal (Assoc. Prof. ME Dept)

Helical tube type radiators are widely used in various engineering applications, such as power generation, HVAC systems, and automotive cooling. Improving the thermal performance of these radiators is crucial for efficient heat transfer and sustainable engineering practices. In this paper, we investigate the effect of varying the parameters that affect the heat dissipation rate of helical tube type radiators, including tube diameter, helix angle, and fluid velocity. A two-dimensional computational fluid dynamics (CFD) model is developed to simulate the heat transfer and fluid flow in a helical tube type radiator. The simulations are conducted using a commercial CFD software package, and the results are validated against experimental data. The effects of varying the tube diameter and fluid velocity are investigated by comparing the heat transfer coefficient and heat dissipation rate of the radiator under different conditions. This study is conducted by varying different parameters that affect the performance of a radiator. The parameters focused in this study are mass flow rate of air, tube diameter, velocity of coolant and nanofluid used.

The results show that increasing the tube diameter leads to an increase in the heat transfer coefficient and heat dissipation rate. However, beyond a certain diameter, the increase becomes marginal. The fluid velocity is also found to be a critical parameter affecting the heat dissipation rate, with a higher fluid velocity resulting in higher heat transfer rates. The simulations also reveal the flow characteristics and temperature distribution inside the radiator, providing insights into the heat transfer mechanisms and fluid dynamics. The results of this study suggest that varying the tube diameter and fluid velocity can significantly improve the thermal performance of helical tube type radiators, leading to more efficient and sustainable engineering practices. Furthermore, the developed CFD model can be used as a tool for optimizing the design and performance of helical tube type radiators in various engineering applications.

DESIGN AND FABRICATION OF SUSPENSION SYSTEM

Team Members- Ashik Ajith, Aswin E P, Ivin Davis, Sanjay Kumar

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

The suspension system is a challenging part of vehicle design that greatly affects vehicle stability during dynamic conditions. It is interconnected with other vehicle systems such as steering, wheels, and brakes. The purpose of this project is to provide comprehensive guidance on the design and calculation of an independent suspension system with double control arms. The necessary parameters, such as shock absorber stiffness, ride frequency, motion ratio, and coefficient of damping, are determined based on a prototype vehicle with a gross weight of 300 kg. Using the calculated values, a CADD model was created with SOLIDWORKS, followed by stress analysis in various software like Ansys. The assembled model was then tested in LOTUS Shark to obtain the results. This project demonstrates the practical application of engineering principles and the ability to design and fabricate a functional suspension system.

DESIGN AND FABRICATION OF ELECTRIC DRIVE TRAIN FOR ALL-TERRAIN VEHICLE

Team Members- Niranjan Sreekumar, Pranav P Menon, Savio Sabu, Shawn M Sandosh

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

This project involves the design and fabrication of a powertrain for an electric all terrain vehicle (ATV). The aim is to develop a high-performance powertrain system that is environmentally friendly and can meet the demands of off-road vehicles. The project comprises the selection of suitable components such as an electric motor, battery, controller, and transmission system. Computer-aided design software is used for the design. Testing and validation of the powertrain system are carried out to ensure its reliability, efficiency and performance. The final product is a fully functional electric ATV with a powerful and efficient powertrain system capable of delivering high torque and speed, making it suitable for off-road applications. The successful completion of this project helps provide valuable knowledge and experience in the design and fabrication of powertrain systems for electric vehicles.

MODELLING, SIMULATION AND OPTIMIZATION OF DI 120 TILLER PRODUCTION LINE

Team Members- Akhilesh S, Akhil James, Leyon T J, Sharon Joseph Poovathingal

Guided by - Mr. Roshan David (Assist. Prof. ME Dept)

The DI120 (Direct Injection) Tiller Production Line was simulated using ARENA software, and further optimized by Design of Experiments and Taguchi Optimization using the software MINITAB. Initially all the details of the production line were captured by observing and studying the various processes of production. The current production line was modelled and simulated in the simulation software ARENA. The model developed was verified and validated by comparing the results obtained by simulation with actual production line records. To optimize the production line, work in progress was selected as the response variable. The levels for each of the factors were fixed by conducting the pilot study on the simulation model. The experiments were designed by Taguchi's Design of experiments. Then, based on signal-to-noise (S/N) ratio, the best sets of levels have been determined to maximize the product output.

DESIGN AND FABRICATION OF STEERING SYSTEM

Team Members- Adithya Das S B, Joshua Varghese, Muralikrishnan K S, Victor Vincent

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

SAE Baja Collegiate Design competition is a nationwide competition in which students teams from many universities compete in a series of events designed to test the Baja vehicle to its limits. Student teams must engineer and build a single seat off-road vehicle. It must be able to traverse rugged terrain like rough roads or steep hills while offering the upmost level of safety for the occupant. A group of 30 students from Christ College of Engineering, Irinjalakuda is participating in this competition at Chitkara University, Baddi in the beginning of April. Six four person teams have designed the frame, drivetrain, suspension, steering, wheel and brake. Our team is responsible for the vehicle's steering design and fabrication. The steering system is an essential component of any vehicle, and its proper functioning is crucial for safe driving. The fabrication process involves several stages, including design, material selection, machining, assembly, and testing. The design phase involves deter- mining the steering system's requirements and specifications, which includes selecting the appropriate steering mechanism, steering column, and other necessary components. Material selection is critical, as it determines the steering system's strength, durability, and resistance to wear and tear. Machining involves shaping the components according to the design specifications, while assembly brings the individual components together to create the complete steering system. Finally, testing is performed to ensure that the steering system functions as expected and meets safety standards. Overall, the successful fabrication of a steering system requires careful attention to detail and a focus on quality control throughout the entire process.

DESIGN AND FABRICATION OF HYDRAULIC DISC BRAKE SYSTEM FOR ATV

Team Members- Antony Peter, Joseph Sam, Ralf Joseph, Vignesh K

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

Hydraulic disc brakes have become the standard in the automotive industry for their reliable and consistent braking performance, especially in challenging conditions. The design and fabrication of hydraulic disc brake systems involves several important factors, including the selection of materials, the configuration of the brake components, and the manufacturing process. The materials used in the design of hydraulic disc brake systems must meet strict requirements for strength, durability, and corrosion resistance. The most common materials used in the manufacture of these systems are high-strength aluminium alloys, stainless steel, and carbon fibre composites. The configuration of the brake components is critical to the performance of the system. The brake calipers, rotors, and master cylinders must be properly aligned and adjusted to ensure consistent braking force and maximum stopping power. The choice of brake pads also plays a crucial role in the performance of the system, with different types of pads offering varying levels of stopping power, durability, and heat resistance. The manufacturing process used to fabricate hydraulic disc brake systems is also critical to the quality, the performance of the final product and also to ensure that each brake system meets the highest standards of performance and reliability.

DESIGNING AND FABRICATION OF STAIR CLIMBING MINIFORK-LIFTER

Team Members- Aghil Johnson, Anjo Paul, Narasimha Thejas M P, Sreehari T S

Guided by – Mr. Reynold Jose (Assist. Prof. ME Dept)

Stair climbing minifork-lifts are a cutting-edge and compact solution for transporting heavy loads up and down stairs. Unlike traditional forklifts that can only be used on level surfaces, these machines have advanced features such as stair-climbing technology, adjustable forks, and ergonomic controls. These features make them ideal for use in multi-story buildings, warehouses, or other facilities with limited elevator access. They provide a safe, dependable, and cost-efficient option for moving goods, equipment, and supplies in tight spaces, making them a valuable tool for companies seeking to streamline their material handling processes. This abstract gives a brief overview of the key features, advantages, and applications of stair-climbing mini-forklifts, emphasizing their versatility and significance in the field of material handling.

DESIGN AND FABRICATION OF PLASTIC EXTRUSION MACHINE

Team Members- Albin P B, Alfred Cheriyan, Amal Francis, Christin Winslet M P

Guided by - Mr. Roshan David (Assist. Prof. ME Dept)

The excessive use of plastic has become a significant contributor to environmental problems. Despite its widespread use in daily life, disposing of plastic is challenging and takes up a significant amount of space. The burning of plastic as a fuel in cement kilns has become an increasingly popular solution for waste plastic disposal. This project presents the design and fabrication of a plastic extrusion machine used for this purpose. The machine was designed to process waste plastic into a form suitable for use in a cement kiln, with the goal of complete combustion with no residue left. The machine was built using readily available materials and tested for its ability to produce extruded plastic of a consistent size and shape. The results showed that the machine was capable of producing high-quality extruded plastic, suitable for use as a fuel in cement kilns. This study provides a practical solution for the environmentally friendly disposal of waste plastic while also providing a source of fuel for cement production.

DESIGN AND ANALYSIS OF FRONT WHEEL HUB

Team Members- Abhiram P Nair, Felix S Thottappilly, Nandana Nandakumar, Vivek Govind

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

An all-terrain vehicle (ATV) wheel assembly is a critical component of ATVs, which are designed to operate in a variety of terrains, including mud, sand, rocks, and hills. The assembly typically consists of a wheel, tire, rim, hub, bearings, and other necessary components such as lug nuts and valve stems. The primary function of the assembly is to provide traction, stability, and control to the vehicle while maneuvering through uneven and challenging terrains. The design and construction of ATV wheel assemblies vary based on the intended use and the type of terrain they will encounter. The assemblies are subjected to rigorous testing to ensure reliability, durability, and safety. Proper maintenance, including tire pressure checks and regular inspection of the bearings and other components, is crucial to ensuring optimal performance and longevity of the assembly. Hub design refers to the process of designing and manufacturing the central part of a wheel or axle, which connects the wheel or axle to the vehicle's chassis or frame. The hub is typically made of metal and can be designed in various shapes and sizes, depending on the intended use and load capacity of the vehicle. The design of the hub must consider factors such as the type of vehicle, load capacity, the number and size of the wheel bolts, and the bearing and lubrication system. The design process typically in- volves computer-aided design (CAD) and finite element analysis (FEA) simulations to ensure optimal strength, durability, and safety. Different manufacturing processes, such as casting, forging, or machining, can be used to produce hubs, depending on the design and materials used. Proper maintenance and regular inspection of the hub are essential to ensure optimal performance and safety of the vehicle.

PERFORMANCE ANALYSIS OF IONIC WIND THRUSTER

Team Members- Alfred Varghese Paul, Anup Antony Joseph, Arun Ajay Kumar, Joyel Joby Kaidharath

Guided by - Dr. Viswanath K Kaimal (Assoc. Prof. ME Dept)

An ionic wind thruster is a type of electric propulsion system that uses ionized gas to generate thrust. This project report provides a comprehensive analysis of the performance and characteristics of ionic wind thrusters. The study focuses on various parameters such as thrust and power consumption, and their relationship with the ionization process and ion acceleration. Experimental data was collected and analyzed to determine the performance of the ionic wind thruster under different operating conditions. The results of the analysis were used to optimize the design of the thruster and identify areas for improvement. The project report also provides an in-depth examination of the relationships between various factors, such as the type and flow rate of the gas used, the voltage ap- plied to the electrodes, the geometry of the thruster components, and their impact on the performance of the thruster. The results of this study provide valuable insights into the performance and capabilities of ionic wind thrusters and can be used to develop more efficient thrusters for a variety of applications. The results of this analysis can help to advance the technology and expand the range of applications for ionic wind thrusters in fields such as space propulsion and aeronautics.

DESIGN AND FABRICATION OF LOOP HEAT PIPE

Team Members- Alex Antony, Alwin Varghese, Johnymon Chungath, Kriswin Jose T

Guided by - Mr. Sanjesh K S (Assist. Prof. ME Dept)

The Loop Heat Pipe (LHP) is a passive, two-phase heat transfer device employed in aerospace and, increasingly, terrestrial applications. A porous wick, placed solely in the evaporator, maintains circulation, and the remaining piping is a conduit for vapour and liquid. LHPs can transport heat over long distances, operate in adverse gravitational positions, tolerate numerous bends and are self- priming due to the compensation chamber passively providing liquid access to the wick. A robust mathematical model of the steady state operation of an LHP for terrestrial high heat flux electronics was created and validated from data generated by an experimental LHP. The LHP was also operated in gravity- adverse and assisted elevations of 5° and 10°. The porous wick has a 60 -13 m 2 permeability and an average pore radius of 1 micrometer. Ammonia was the chosen working fluid. The predicted values during the constant conductance mode of operation accurately reflected the experimental results.

SMART WATER HEATER WITH INTELLIGENT WATER MIXING SYSTEM

Team Members- Alex Neelankavil, Antony Jose, Aravind C Menon, Rahul P S

Guided by - Mr. Sunil Paul (Visiting Faculty ME Dept) & Ms. Aswathy P Sajeev (Assist. Prof. ME Dept)

Water is the most valuable natural resource after air without which a man cannot survive. The growing demand is forcing fresh water beyond natural replenishment rates. We recognize that there is significant water wastage at households and public places as users try to find a proper setting or ratio in manual mixing of hot and cold water. There is in need of a smart system that can handle the demand of hot water and simultaneously serve the users with water at required temperature as well as regulated pressure. With this project, we are aiming to convert a normal electric water heater to a smart water heater with mixing system that provides water to users at the required temperature and flow rate with the convenience of controlling the water heater through mobile phones using voice assistant(Google Assistant).

DESIGN, ANALYSIS AND FABRICATION OF ROLL CAGE OF AN ELECTRIC ATV

Team Members- Jayakrishnan T, Ashwin Suresh, Steve Austin, Mridhul C V

Guided by - Mr. Dony Dominic (Assist. Prof. ME Dept)

The project aims to design and analyze the roll cage of an electric all-terrain vehicle (ATV). The focus of the study is to ensure that the roll cage provides adequate protection to the occupants in the event of a rollover while also being lightweight and optimized for strength. The design process will involve the selection of materials and manufacturing process followed by simulation and testing to verify the performance of a roll cage under various scenarios.The analysis will be carried out using finite element analysis(FEA) techniques to assess the structural integrity and safety of the roll cage design. The outcome of this project will provide insight into the design and optimization of roll cages for electric ATVs and contribute to the overall safety of the vehicle.

Chief Editors: Prof.(Dr.) Sijo M T (HOD, ME) and Editors: Dr. Arun Augustin(AP, ME), Mr. Leyon T J,
Mr. Sharon Joseph Poovathingal. Contact: Mob: 9847520278, 9740641930, 9496230500, 7902490425
E-mail:sijomt@cce.edu.in, arunaugstin@cce.edu.in, leyon19me@cce.edu.in, sharon19me@cce.edu.in