VOL 3 | 2024

MAHARAJA AGRASEN INSTITUTE OF TECHNOLOGY

MECHANICA

DEPARTMENT OF MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To be a global leader in Mechanical Engineering education, research & innovation with ethics and values.

MISSION

M1: To deliver industry relevant and skill oriented education in Mechanical Engineering, encompassing production, design, thermal, and emerging areas to address diverse global challenges.

M2: To foster ethical values with professional skills for the benefit of industry and society.

M3: To enhance the teaching-learning process through modern pedagogical tools.

M4: To promote research, innovation and entrepreneurship using sustainable technologies and continuous learning.

M5: To strengthen engagement with alumni, industry and other stakeholders for collaborative growth and capacity building.

PROGRAM EDUCATIONAL OBJECTIVES

The objectives of the department of Mechanical Engineering are to produce graduates who will have:

PEO1: Employability, entrepreneurship, leadership skills, and the ability to pursue higher education for the enhancement of knowledge.

PEO2: Ability to lead through research and innovation in the field of Mechanical Engineering.

PEO3: Engineering competence with good communication skills, professionalism, moral values as well as foundation for lifelong learning.

PEO4: Technical capabilities pertinent to Mechanical and allied engineering and to provide innovative and sustainable solutions for industrial and societal problems.

PROGRAM SPECIFIC OUTCOMES

PSO1: Ability to explore and apply advanced technologies such as robotics, AI-ML, data science etc. in the field of Mechanical Engineering.

PSO2: Ability to conduct experiments and use of simulation tools for engineering problems, meeting industry and societal needs.

PSO3: Ability to pursue advanced studies, develop entrepreneurial skills and manage engineering projects in creating innovative solutions.

Message From Founder & Chief Advisor's Desk

It is indeed a matter of great pride that the Department of Mechanical Engineering, MAIT is publishing its annual technical magazine in July, 2024.

The technical magazine, I understand, showcases the research activities and industry – academia interaction activities which the department has adopted during last year.

I sincerely acknowledge the dedicated efforts of the faculty and staff of the Department of Mechanical Engineering in the successful release of this magazine.

I also extend my heartfelt congratulations to the Editorial Team for ensuring its publication.

I wish them all the very best in their future endeavors.

Dr. Nand Kishore Garg
Founder & Chief Advisor, MATES

Message From Chairman's Desk

I am gratified to know that the Department of Mechanical Engineering, MAIT has taken an initiative to publish the Technical Magazine in the month of July 2024. This is productive as well as a great platform for the students, researchers, faculty members and industry experts to disseminate achievements in research and developments in computer science and technology.

I gratefully acknowledge Dr. Vaibhav Jain, Head of the Mechanical Engineering Department, along with the faculty and students, for their valuable contributions to the publication of the Technical Magazine. My special appreciation goes to the Editorial Team for their commendable coordination in bringing this issue to life.

Wishing them continued growth and success in all their endeavors.

Sh. Vineet Kumar Lohia
Chairman, MATES

Message From Director General's Desk

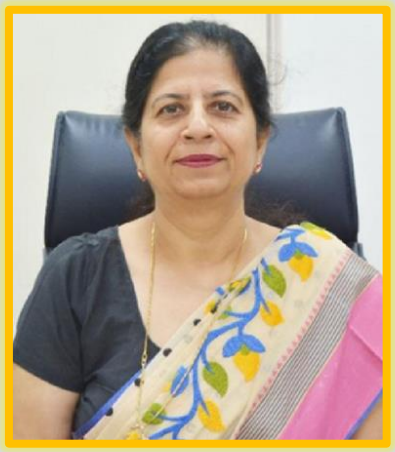
I am very happy that Department of Mechanical Engineering, MAIT is releasing its Technical Magazine to commemorate technical publications and articles of faculties, alumni's and students for the academic year 2023 – 2024.

This Technical Magazine is a forum which could aptly be used for recording the technical articles and research papers published by the students and faculty members. I am sure that this magazine will be informative and resourceful.

I owe my hearty appreciations to Dr. Vaibhav Jain, Head, Department of Mechanical Engineering and his team for their sincere efforts to make the release of this magazine a reality.
I wish them the very best in all their future endeavors.

Prof. (Dr.) J.V. DESAI
Director General
Maharaja Agrasen Institute of Technology

Message From Director's Desk



I am extremely happy to know that the Department of Mechanical Engineering, MAIT is publishing its annual technical magazine in July 2024.

This annual technical magazine will showcase the interaction of the Mechanical Department with Industry Professionals, Academicians and Research Scientists. It will also show the research by faculties of Mechanical Engineering.

I wholeheartedly applaud the Head of the Department, the Editorial Team, and the coordinators for their commendable efforts in publishing this issue. I extend my best wishes for continued success in all their future publications.

May their passion and dedication continue to inspire excellence in every edition.

Prof. (Dr.) Neelam Sharma
Director
Maharaja Agrasen Institute of Technology

Message From Dean's Desk

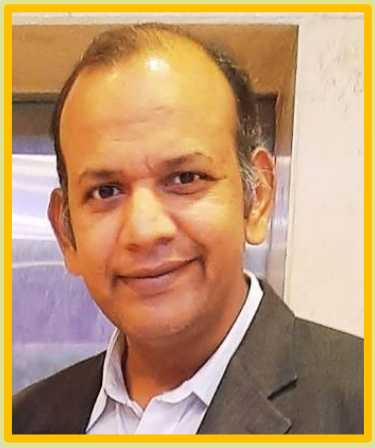
It is a moment of pride for us to print the new edition of the annual technical magazine of the Mechanical Engineering. Creativity and innovation are the catalyst of advancement. For the time immemorial, education emancipates. No study is complete when the scope of further research is available.

Research is the fuel for advancement and development. This magazine will share and exchange the scientific knowledge of our teachers who are not only academicians but also researchers with the students.

I congratulate and compliment the entire team, faculty members, staff and fellow students for initiating this magazine to exchange their views and knowledge on recent research and developments**.**

Prof. (Dr.) S.S. Deswal
Dean
Maharaja Agrasen Institute of Technology

Message From Dean (Research & Innovation)



I am very proud and excited as we present this annual technical magazine to bring together the achievements, activities, and research contributions of both our students and faculty. Our department has made great inroads in innovation, research, and academic excellence. This magazine showcases our strides as the sum total of our collective efforts.

I extend my heartfelt congratulations to each one of you for contributing your works to this issue of the annual technical magazine. Your research papers, projects, and stories of innovation reveal dedication, creativity, and enthusiasm for engineering.

Let us stretch the frontiers of knowledge and innovation with a spirit of inquiry, collaboration, and entrepreneurship. Let's work together toward solving complex global challenges for a better future for everyone. I would like to, in particular, acknowledge the faculty and students who have acquired research grants, published papers, and filed patents. Your contributions bear testimony to our institution's commitment to excel in research and innovation.

Congratulations to the editorial team for an excellent compilation for the current issue of the magazine. Let us keep the celebration of success going on and work as a team on our challenges, toward the collective goals leading to our Institute’s mission.

Dr. Sachin Gupta
Dean (R&I)

Message From Head of the Department

It is a matter of great pride and privilege for us to be associated with the department of mechanical engineering for this 5th year. The year 2023-24 has been a year of accomplishments for the Department.

One faculty member of the Department received their Ph.D. degrees from Jamia University and Delhi Technological University. The department celebrated 'Earth Day' in association with Institute innovation cell (IIC) and ASHRAE Student Branch MAIT. A huge number of faculty members and students participated in this online event.

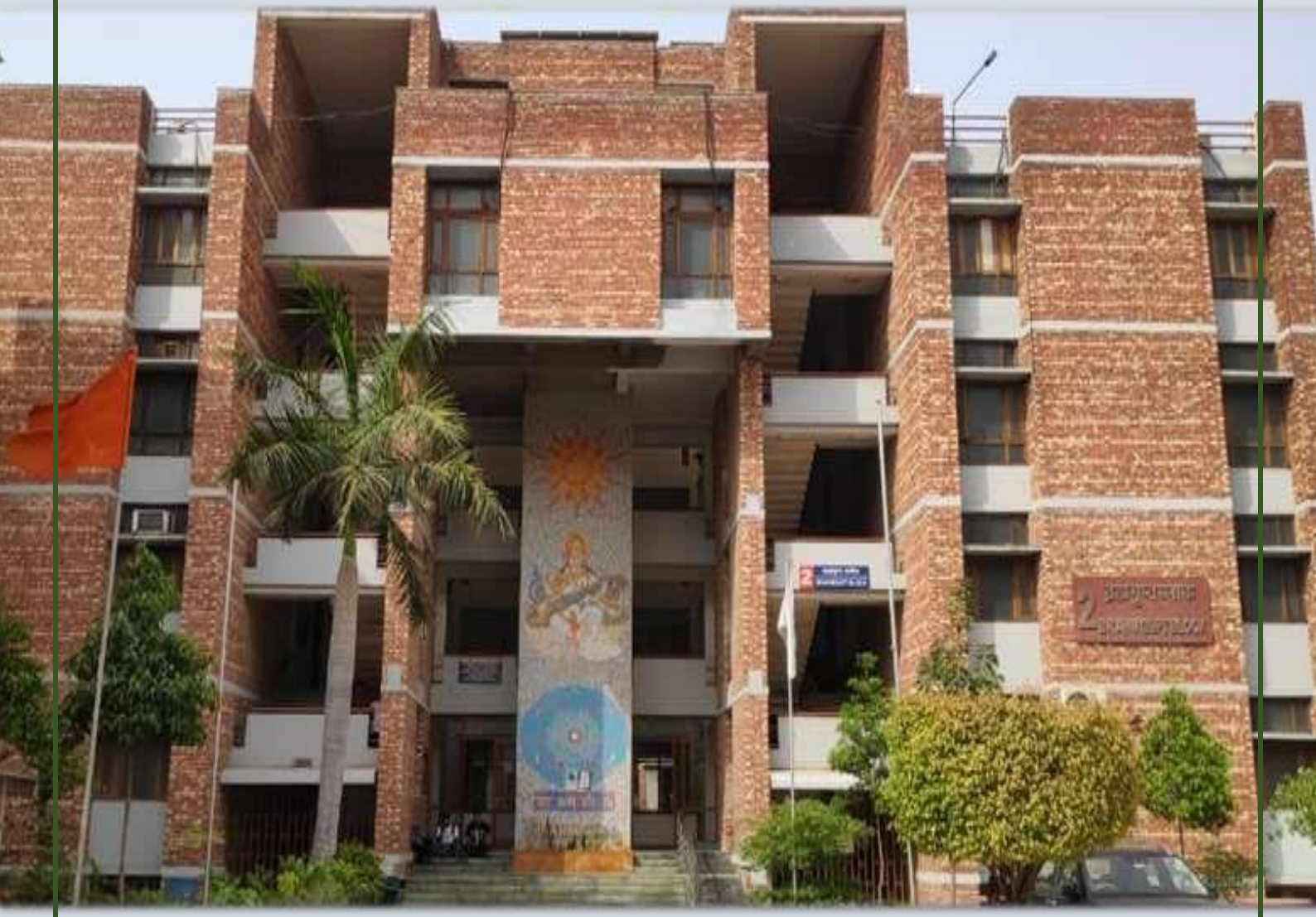
Many events were organized by the department. Several hands-on activities have been also arranged by department students, faculties, and the ASHRAE society of MAIT.

It is a difficult task to include information about all the activities of the department in an annual magazine like this.

I congratulate Dr. Garima Sharma & Dr. Alok Kumar who worked tirelessly to bring out this edition of the magazine**.**

Dr. Vaibhav Jain
Head, Department of Mechanical Engineering
Editor-in-Chief, Technical Magazine

Faculty Members
Department of Mechanical Engineering



Dr. Vaibhav Jain (HoD)
Dr. V. N. Mathur
Dr. Anil Kumar Dahiya
Mr. Anil Gupta
Dr. Deshdeep Gambhir
Dr. Sidharth
Dr. Kanchan Mudgil

Ms. Surabhi Lata
Dr. Vipin Kumar Sharma
Dr. Sumit Joshi
Dr. Naveen Solanki
Dr. Piu Jain
Mr. Rakesh Chander Saini
Ms. Surbhi Upadhyay
Dr. Sachin Gupta

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Explore the Ocean of Faculty Perspectives

Industry 4.0 and Smart Manufacturing

Dr. Anil K. Dahiya

Industry 4.0, often referred to as the Fourth Industrial Revolution, marks a significant shift in how manufacturing and industrial processes operate. It integrates advanced digital technologies into traditional manufacturing, creating what is now known as Smart Manufacturing. This evolution builds on previous industrial revolutions—mechanization, electrification, and automation—but takes it further by introducing cyber-physical systems, the Internet of Things (IoT), big data analytics, cloud computing, artificial intelligence (AI), and machine learning (ML) into production environments. At its core, Industry 4.0 aims to create a connected, intelligent, and autonomous manufacturing ecosystem.

Machines, devices, and sensors are interconnected through IoT, allowing seamless communication and data sharing in real-time. This connectivity enables manufacturers to monitor and optimize operations continuously, resulting in increased efficiency, flexibility, and productivity. One of the hallmarks of Smart Manufacturing is predictive maintenance. By analyzing data from sensors embedded in machinery, manufacturers can predict equipment failures before they occur. This minimizes downtime, reduces maintenance costs, and extends machinery lifespan. Similarly, real-time data analytics empower decision-makers with actionable insights, enabling quick responses to production issues and market demands. Another significant aspect is automation and robotics. Smart factories use robots for repetitive or dangerous tasks, ensuring higher precision and safety.

These robots, often guided by AI, can adapt to changes in production without human intervention. Moreover, collaborative robots (cobots) work alongside human operators, enhancing productivity without replacing the human workforce. Customization and flexibility are also enhanced in Industry 4.0 environments. Using digital twins—virtual replicas of physical assets—manufacturers can simulate and optimize processes before actual implementation. This capability facilitates mass customization, allowing companies to produce personalized products at scale without sacrificing efficiency. Smart Manufacturing contributes significantly to sustainability. By optimizing resource usage and reducing waste, companies can lower their environmental footprint.

Energy consumption can be monitored and controlled, helping organizations meet sustainability goals and comply with regulations. Despite its numerous advantages, the transition to Industry 4.0 presents challenges. Cybersecurity is a major concern, as increased connectivity exposes systems to potential cyber threats. Furthermore, the initial investment in

technology, training, and infrastructure can be substantial. However, the long-term benefits—such as improved competitiveness, faster innovation cycles, and enhanced customer satisfaction—often outweigh these initial costs. In conclusion, Industry 4.0 and Smart Manufacturing are transforming the industrial landscape. By embracing digital transformation, companies can unlock new levels of efficiency, innovation, and agility. As the technology continues to evolve, it will become increasingly essential for manufacturers to adapt to this new era of intelligent production, ensuring their place in the future of global industry.

Harnessing Data Science: Revolutionizing Mechanical Engineering

Dr. Vipin K. Sharma

In the ever-evolving landscape of mechanical engineering, the fusion with data science is sparking transformative changes. This interdisciplinary approach is not just enhancing traditional methods but also pioneering new pathways in design, maintenance, and operational efficiency.

Mechanical engineering, traditionally reliant on empirical testing and iterative design, is now benefiting from data science. Advanced analytics and machine learning enable engineers to analyze extensive datasets from simulations and experiments. This data-driven approach refines design parameters, accelerates development cycles, and enhances product quality. Techniques such as surrogate modeling and design of experiments allow for more efficient exploration of design spaces, leading to superior engineering outcomes.

Predictive maintenance is a key area where data science is making a significant impact. By analyzing sensor data with sophisticated algorithms, engineers can anticipate potential equipment failures before they occur. This proactive approach extends the lifespan of machinery, reduces downtime, and cuts maintenance costs. Leveraging historical and real-time data helps in identifying signs of wear and tear, ensuring smoother operations and more cost-effective maintenance strategies.

In process optimization, data science is proving invaluable. Techniques such as statistical process control and regression analysis are refining manufacturing processes, improving quality control, and minimizing waste. For example, in additive manufacturing, predictive models are used to fine-tune parameters for better efficiency, while real-time data analysis enhances the performance of HVAC systems. Simulation and modeling practices are also being redefined through data science. High-fidelity simulations produce large datasets that, when analyzed with machine learning, lead to more accurate models and predictions. This synergy is advancing fields such as fluid dynamics, structural analysis, and thermal management. Data-driven simulations enhance accuracy and reliability, speeding up the development of innovative engineering solutions.

The ongoing exploration of data science within mechanical engineering is reshaping the field, blending innovative methodologies with established practices. As data science continues to evolve, its influence on mechanical engineering promises to expand, unlocking new opportunities for advancement and efficiency. The synergy between data and engineering is set to drive the next wave of breakthroughs, paving the way for smarter, more efficient, and more resilient engineering solutions.

Sustainable Energy Source

Introduction

Dr. Sidharth Bansal

The increasing demand for cleaner and more sustainable energy sources has led to a surge in research on alternative fuels for internal combustion engines. Among these, higher alcohols have emerged as a promising candidate for diesel engines. Unlike their lower alcohols (methanol and ethanol), higher alcohols, such as butanol, pentanol, octanol etc. offer a unique combination of properties that can significantly improve engine performance and reduce emissions.

Properties and Benefits of Higher Alcohols

Higher alcohols possess several characteristics that make them attractive as diesel fuel additives or substitutes:

- **Oxygen content:** Higher alcohols contain oxygen, which aids in complete combustion, leading to reduced particulate matter (PM) and hydrocarbon (HC) emissions.
- **Cetane number:** While lower than diesel, the cetane number of higher alcohols is still adequate for ignition. Blending with diesel can improve overall cetane number.
- **Higher energy density:** Compared to lower alcohols, higher alcohols have higher energy content, resulting in better fuel economy.
- **Reduced soot formation:** The oxygen content and higher energy density contribute to reduced soot formation, improving engine efficiency and extending engine life.
- **Lower NOx emissions:** In some cases, higher alcohols have been shown to reduce NOx emissions, although this can vary depending on engine operating conditions and blend composition.
- **Bio-based production:** Higher alcohols can be produced from renewable sources like biomass, making them a sustainable fuel option.

Performance and Emissions Characteristics

Studies have shown that blending higher alcohols with diesel fuel can lead to improvements in engine performance and emissions:

- **Improved combustion:** The oxygen content in higher alcohols enhances combustion, resulting in better fuel efficiency and reduced smoke emissions.
- **Reduced particulate matter:** Higher alcohols contribute to a reduction in particulate matter, a significant health and environmental concern.
- **Lower hydrocarbon emissions:** The complete combustion promoted by higher alcohols leads to lower hydrocarbon emissions.
- **Potential for NOx reduction:** While not always consistent, some studies have reported reductions in NOx emissions with higher alcohol blends.
- **Cold start performance:** Higher alcohols may exhibit slightly longer ignition delay compared to diesel, potentially affecting cold start performance.

Challenges and Future Directions

Despite the promising potential of higher alcohols, several challenges need to be addressed for widespread adoption:

- **Fuel cost:** The current production cost of higher alcohols is relatively high compared to conventional diesel fuel.
- **Infrastructure:** The distribution and storage infrastructure for higher alcohols needs to be developed.
- **Engine compatibility:** Long-term engine durability studies are required to assess the compatibility of higher alcohol blends.

To overcome these challenges, continued research and development are essential. Focus areas include:

- Developing efficient and cost-effective production processes for higher alcohols.
- Optimizing higher alcohol blends for different engine types and operating conditions.
- Investigating the impact of higher alcohols on engine wear and durability.

Conclusion

Higher alcohols offer a promising pathway to reduce emissions and improve the environmental performance of diesel engines. While challenges remain, ongoing research and development efforts are likely to pave the way for the wider adoption of this sustainable fuel option. As the world transitions towards cleaner energy sources, higher alcohols have the potential to play a significant role in the future of transportation.

Pelletisation of Biomass: Issues and Benefits

Dr. Kanchan Mudgil

The use of biomass energy in India holds significant promise for enhancing energy security, supporting rural development, and reducing environmental impacts. It helps reduce dependence on non-renewable energy sources, contributing to energy security. Biomass utilizes waste materials, such as crop residues and wood chips, which otherwise contribute to environmental pollution. Converting these wastes into energy not only addresses disposal issues but also provides a valuable resource. The biomass sector creates jobs and supports local economies, particularly in rural areas where biomass resources are abundant. It provides employment opportunities in collection, processing, and energy production.

The palletised form of biomass is more convenient for use in energy production systems, such as biomass power plants and industrial boilers. Palletisation refers to the process of compressing biomass into compact, uniform pellets or briquettes. This method enhances the efficiency of biomass handling, storage, and transportation. Palletised biomass has various benefits. It has a higher energy density compared to loose biomass, reducing the volume required for storage and transportation. This results in cost savings and more efficient logistics. The uniform size and density of pellets lead to more consistent combustion in energy generation systems, which improve heat output and reduced ash production, enhancing overall efficiency. It simplifies the handling process by allowing the use of automated systems for loading, unloading, and transporting biomass.

However, high initial investment, uniform size of pallets, and energy requires for compressing and drying biomass, are becoming challenges for the full potential of biomass energy. India can advance its renewable energy goals and contribute to a more sustainable future.

IOT-based Manufacturing Sector


Ms. Surabhi Lata

The Internet of Things has showcased its ability in every sector of the market. It has proven its potential from its existence in our daily life to vast sectors like manufacturing, hospitality, automobiles, aerospace etc. If we look around, we are surrounded by several IoT devices that we are using very efficiently. It has impacted every human, becoming a part of them.

IoT refers to the system of interconnected physical devices and sensors that communicate, collect and exchange data. It is a technology that has revolutionised traditional working style into innovative and cost-efficient working style. Today's industries are now reaping benefits from IoT based techniques to enhance their outputs. According to a research, ***experts are expecting a growth in the global IoT in manufacturing market size from USD 33.2 billion in 2020 to USD 53.8 billion in 2025, at a Compound Annual Growth Rate (CAGR) of 10.1%***.

IoT is making the manufacturing industry smart and efficient by interconnecting the machines, systems and data. The technique involved in implementation of IoT technologies has been discussed in this article.

1. The industry now has a Vision-based strategic planning which formulates goals for IoT implementation, assess current capabilities to align them with IoT goals and generation of a roadmap for its successful integration at various stages.
2. The industry is more focussed on infrastructure and technology to coalesce the benefits of IoT devices for good connectivity, assess operations, environment and performance of machines through IoT devices and sensors and implementation of edge computing solutions to assist real-time decision making.
3. Data management and analytics is an integral part of any industry for a sound performance. The IoT devices help in gathering data and storing it on cloud or on-premises storage. Further, advanced analytics and machine learning help in identifying the future patterns, facts and figures and even any type of equipment failures or maintenance requirements.
4. The industry's existing systems such as enterprise resource planning, manufacturing execution system are now integrated with the IoT data, devices. The industry now works on the principle of predictive and preventive maintenance for the machinery.
5. The data security and implementing privacy regulations through encryption, securing access control and regular security audits.
6. Time-to-time scheduling of trainings for upgrading the employee and staff in regard to the IoT technologies.
7. The industry is optimizing the IoT implementations through regular monitoring of performance and feedback systems. With such strategies, they aim to expand the IoT technologies to other sectors of manufacturing.

8. Another aspect to work on is selection of reliable IoT device manufacturers, service and technology providers, system integrators. The industry keenly observes the updates on the latest innovations and practices and then make a final decision.
9. The industry during the implementation of IoT technologies has to adhere to industry standards and comply with industry-specific regulations and standards related to safety, quality, and environmental impact.

The discussed framework enables the manufacturing industries to effectively harness the power of IoT to drive efficiency, innovation, and competitive advantage in compliance to the industry standards and regulations. IoT technology is applicable from as small as smart phones, laptops, iPads etc to the vast machinery producing the same products with greater precision and low production time in cost-efficient manner.

"A technological step towards new technology for manufacturing technologically advanced equipment with technology-based security systems."

Artificial Intelligence in Manufacturing: Opportunities and Challenges

Dr. Sumit Joshi

Artificial intelligence (AI) in the manufacturing industry provides a roadmap for the application of robot-related AI technologies and how they can transform the industry.

AI provides unique capabilities over conventional tools and approaches in manufacturing. By identifying and classifying multivariate, nonlinear patterns in operational and performance data, AI provides the ability to transform large amounts of complex manufacturing data into actionable and insightful information. This information can complement other physical characteristics of a system or process which helps solve complex problems. Using AI, manufacturers can reduce errors and meet throughput, quality, and cost objectives while ensuring a safe working environment for all.

AI can transform the manufacturing industry by providing insights into the following areas - prediction, diagnosis, prognosis, maintenance optimization, and knowledge discovery. AI-based predictive modeling can forecast outcomes by converting raw sensor data into meaningful events and making predictions based on those events. It can also analyze the performance and functioning of complex systems to enable accurate diagnosis of faults. Through AI-powered prognostic approaches, manufacturing systems can benefit from precise awareness of how long equipment will last and when it will fail. Optimizing maintenance schedules can lead to cost savings by reducing downtime of equipment.

Using AI in manufacturing requires a multidisciplinary approach, combining AI and machine learning techniques with manufacturing domain knowledge. It highlights the need for domain experts, machine learning experts, and data scientists to work collaboratively on AI projects. It also states that AI should not replace machine operators and technicians but support them by offering new information and insights about the manufacturing systems.

In summary, AI is driving significant transformation in manufacturing by offering the ability to process and analyze complex data, leading to enhanced outcomes. AI promises to reduce errors, boost efficiency, and optimize maintenance schedules. However, its successful implementation depends on the collaborative efforts of domain and AI experts.

Teaching Design Thinking & Innovation

In today's fast-paced and complex world, creativity, adaptability, and problem-solving skills are more valuable than ever. To meet these demands, many educational institutions and organizations are turning to Design Thinking and Innovation as essential tools for preparing students and professionals for the challenges of the 21st century. Teaching these skills equips individuals with a human-centered, solution-focused approach to tackling real-world problems and fostering innovation across diverse fields. Design Thinking is a structured, iterative process for creative problem-solving that emphasizes empathy, experimentation, and collaboration. It typically follows five key stages: Empathize, Define, Ideate, Prototype, and Test. By first understanding the needs and experiences of users, participants are guided to create solutions that are both functional and meaningful. One of the core strengths of teaching Design Thinking lies in its interdisciplinary nature. It encourages learners from various backgrounds—engineering, business, arts, healthcare, and more—to collaborate and think beyond traditional boundaries. This diverse approach often results in more innovative and inclusive solutions, as it blends different perspectives and expertise. Teaching innovation alongside Design Thinking focuses on fostering a mindset that embraces creativity, risk-taking, and resilience. Innovation is not just about coming up with new ideas but about executing ideas that create value. In the classroom or training environment, this can be cultivated through hands-on projects, real-world case studies, and open-ended challenges that encourage learners to think boldly and experiment freely. Effective teaching of Design Thinking and Innovation often relies on active learning methods. These include workshops, hackathons, team-based projects, and design sprints—all of which immerse learners in practical experiences. Through these activities, students learn to iterate rapidly, accept failure as a learning opportunity, and refine their ideas based on feedback. Technology integration also plays a key role.

Digital tools such as collaboration platforms, virtual whiteboards, and prototyping software enhance the learning experience, especially in remote or hybrid environments. These tools help simulate real-world innovation processes and allow learners to visualize and test their ideas more effectively. Another crucial component is the role of the facilitator or educator. Rather than simply delivering content, instructors in Design Thinking act as coaches and mentors, guiding learners through exploration, encouraging reflection, and helping them develop their own creative confidence. The impact of teaching Design Thinking and Innovation goes beyond academic or professional success. It nurtures critical thinking, empathy, and a proactive mindset, which are valuable in all aspects of life. Learners become change-makers, capable of identifying problems, envisioning solutions, and bringing about positive change in their communities and industries. In conclusion, teaching Design Thinking and Innovation is about empowering people to think differently and to approach challenges with creativity, empathy, and a willingness to experiment. As the demand for innovative solutions continues to grow, equipping learners with these skills ensures they are prepared not only to adapt to the future but to shape it.

Student Intellectual Expression

The performance solution Cell to Body (CTB) Technology

R Vignesh
07714803620

BYD's innovative Cell to Body (CTB) technology marks a significant leap forward in electric vehicle (EV) development, fundamentally reshaping how battery systems are integrated into vehicle architecture. Introduced in 2022, CTB integrates battery cells directly into the vehicle's body structure, leveraging the battery pack as a structural component rather than a separate entity. This integration not only enhances the vehicle's rigidity and safety but also contributes to improved performance across various metrics.

Structural Integration and Design Advantages: The core of BYD's CTB technology lies in its structural integration approach. The battery pack features a unique sandwich structure comprising an upper cover, BYD's Blade Battery cells, and an underbody protection tray. This design maximizes volume utilization, achieving an impressive 66% utilization rate. By integrating the battery pack with the body, CTB enhances the vehicle's overall structural strength, significantly reducing intrusion in frontal, small-overlap, and side-pole impacts. This structural enhancement translates into a 70% increase in torsional stiffness and a 57% increase in bending stiffness, leading to superior handling dynamics and enhanced passenger comfort. A strong “sandwich” structure that can achieve a remarkable torsional rigidity of 40,500N.m/o. CTB (Cell to Body) is a new way of battery cell integration proposed by BYD to realize the Transformation from body integration to battery-body integration, which helps to improve space utilization and further performance release of electric vehicles.

Performance and Efficiency Gains: Beyond structural benefits, CTB empowers E-Platform 3.0 with advanced performance capabilities. The platform achieves a balanced 50:50 golden axle load distribution ratio, optimizing stability and handling. Moreover, CTB enhances vehicle responsiveness with a reduced response time of over 50 milliseconds, ensuring quicker acceleration and maneuverability. The platform features an efficient All Wheel Drive (AWD) architecture optimized for maximum lateral acceleration of 1.05g. The front wheels are driven by AC synchronous motors, ensuring reduced energy consumption, while the rear wheels utilize permanent magnet synchronous motors for ample power delivery. This configuration not only enhances AWD coordination but also achieves remarkable energy efficiency, consuming as little as 12.7 kWh per 100 kilometers.

Technological Integration and Innovation: CTB technology integrates seamlessly with its Intelligent Torque Control System (ITAC), enhancing vehicle state recognition and response

precision by over 300 times. The integration of four key layers — application, service, network, and physical — further enhances operational efficiency and connectivity, setting a new benchmark in EV technology integration.

Future Prospects and Industry Impact: Looking ahead, CTB represents a pivotal advancement in EV design, promising to reshape future generations of electric vehicles. By optimizing weight distribution, lowering the vehicle's centre of gravity, and improving overall handling dynamics, CTB not only addresses current technological challenges but also sets a foundation for continued innovation in sustainable mobility.

Conclusion: BYD's Cell to Body (CTB) technology stands at the forefront of EV innovation, redefining how battery systems integrate with vehicle structures to enhance safety, performance, and efficiency. With its robust structural design, advanced integration capabilities, and transformative impact on electric mobility, CTB heralds a new era of sustainable transportation solutions. As electric vehicle technology continues to evolve, BYD's commitment to pushing the boundaries of innovation through CTB ensures a promising future for cleaner, more efficient transportation worldwide.

Hydrogen: The Clean Powerhouse Poised to Revolutionize Industries

Adnan Anwar
01014803620

The rumble of internal combustion engines (ICEs) has dominated our roads for over a century, leaving a trail of pollution in their wake. Battery electric vehicles (EVs) are buzzing with potential, but range anxiety and charging infrastructure limitations still linger. However, a silent revolution is brewing – Hydrogen Fuel Cell Vehicles (HFCVs) are poised to take the lead in the race for sustainable transportation. Hydrogen, the most abundant element in the universe, offers several advantages as a fuel source for the automotive industry and many others. Here's why hydrogen is the green machine that will leave both EVs and ICEs in the dust and not only the automotive industry but also other industries. Coming up with the first and foremost point, unlike EVs, HFCVs don't rely on the often-unclean electricity grid. They harness the potential of hydrogen, the most abundant element in the universe. Inside an HFCV, a marvel of engineering called a fuel cell combines hydrogen with oxygen, producing electricity to power the vehicle or machinery. The only byproduct? Clean water vapor. This Efficiency Unleashed: Power When You Need It: EVs are lauded for their efficient energy conversion, but their limited range can be a drawback. FCVs, however, offer a game-changer. Speaking of efficiency, hydrogen fuel cells are remarkably efficient. A hydrogen Fuel Cell Vehicle (FCV) converts chemical energy into electrical energy with an efficiency of about 60%, significantly higher than the 25-30% efficiency of traditional ICE vehicles. An HFCV can be refueled in approximately 5 minutes and can travel up to 400 miles on a single tank, making it comparable to ICE vehicles and far superior to the charging times and ranges currently achievable by most Battery Electric Vehicles (BEVs). Whether on the road or powering industrial equipment. This translates to extended operation times and reduced downtime, a crucial factor for industries demanding consistent performance. Additionally, refueling an HFCV is a quick process, mirroring the familiar convenience of gas stations.

Sustainability's Secret Weapon: Clean Fuel from Clean Sources: But hydrogen's magic goes beyond just clean operation. This positions hydrogen as a critical player in reducing air pollution and combating climate change. Additionally, hydrogen can be produced through various sustainable methods, such as electrolysis using renewable energy sources like wind, solar, and hydropower. This creates a closed-loop system where the energy used to produce hydrogen is replenished by the natural energy cycle. This disrupts our dependence on fossil fuels, severing the link between industrial activity and greenhouse gas emissions.

Beyond Cars: A Green Revolution for All Industries: The potential of hydrogen extends far beyond personal vehicles. HFCVs can power heavy-duty trucks and buses, construction equipment, and even maritime vessels. Their long-range and fast refueling makes them ideal for demanding applications, paving the way for a clean and sustainable future across various industries. Imagine clean ports, construction sites free from harmful emissions, and long- haul transportation with a minimal environmental footprint.

The Road Ahead: Challenges and Triumphs: While there's still work to be done – expanding hydrogen refueling infrastructure and cost reduction there are key hurdles too and the momentum behind hydrogen is undeniable. Leading companies and Governments worldwide are recognizing the potential of hydrogen and are committing to building the necessary infrastructure. Policies and incentives are being put in place to accelerate the adoption of hydrogen technologies, ensuring that hydrogen becomes a cornerstone of the sustainable energy landscape

The conclusion to this article says that hydrogen fuel stands out as a superior alternative to both EVs and ICE vehicles in the quest for sustainable transportation and in different industries, its high efficiency, quick refueling times, long driving ranges, and minimal environmental impact make it an ideal candidate for various industries. As technology advances and infrastructure expands, hydrogen has the potential to become the clean energy source that revolutionizes entire industries, propelling us toward a cleaner, more sustainable world. As we all know, evolving for a better future is always the major principle in achieving great heights.

Nanotechnology in Mechanical Engineering

Shivam Sharma
08714803620

Nanotechnology, the manipulation of matter on an atomic and molecular scale, is revolutionizing the field of mechanical engineering. This technology, which operates at the nanometer scale (one billionth of a meter), is opening up new possibilities for material science, manufacturing, and overall engineering performance. The integration of nanotechnology into mechanical engineering is paving the way for advancements that were once considered the realm of science fiction.

One of the most significant impacts of nanotechnology in mechanical engineering is in the development of advanced materials. Nanomaterials, which include nanoparticles, nanotubes, and nanocomposites, possess unique properties that traditional materials lack. These materials exhibit exceptional strength, lighter weight, enhanced thermal and electrical conductivity, and improved chemical resistance. For instance, carbon nanotubes are incredibly strong and lightweight, making them ideal for applications that require high strength-to-weight ratios, such as aerospace components and advanced automotive structures.

In manufacturing, nanotechnology is enabling the creation of more precise and efficient processes. Nanofabrication techniques allow engineers to construct components with atomic precision, leading to the production of devices with enhanced performance and reliability. This precision is particularly crucial in the semiconductor industry, where the ability to manipulate materials at the nanoscale is driving the development of smaller, faster, and more powerful electronic devices. Furthermore, nanoscale coatings and surface treatments are being used to improve wear resistance, reduce friction, and enhance the lifespan of mechanical components.

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Nanotechnology is also playing a vital role in the field of energy. Nanomaterials are being used to develop more efficient energy storage systems, such as batteries and supercapacitors, which are critical for the advancement of renewable energy technologies. For example, lithium-ion batteries with nanostructured electrodes offer higher energy densities and faster charging times compared to conventional batteries. Additionally, nanotechnology is contributing to the development of more efficient solar cells by enabling the creation of nanostructured materials that can capture and convert sunlight more effectively.

In the realm of health and safety, nanotechnology is facilitating the creation of more effective sensors and diagnostic tools. Nanosensors, which can detect chemical and biological agents at extremely low concentrations, are being integrated into mechanical systems to monitor

environmental conditions, detect structural failures, and ensure the safe operation of machinery. These sensors can provide real-time data, allowing for predictive maintenance and reducing the risk of catastrophic failures.

Nanotechnology is transforming the field of mechanical engineering, offering unprecedented opportunities to enhance material properties, improve manufacturing processes, and develop advanced energy solutions. As research and development in this field continue to progress, the integration of nanotechnology into mechanical engineering will likely lead to even more groundbreaking innovations. The potential of nanotechnology is vast, and its impact on mechanical engineering is only beginning to be realized.

Automation & Robotics: Transforming Industries and Shaping the Future

Piyush
20114811123

Automation and robotics represent two of the most transformative forces in modern industry, catalyzing a revolution that is reshaping the way we live, work, and interact with the world around us. Automation, the use of technology to perform tasks with minimal human intervention, and robotics, the design and deployment of machines capable of executing complex actions autonomously, have evolved in tandem to create systems that are more efficient, accurate, and versatile than ever before. Together, these technologies are driving advancements across numerous sectors, from manufacturing and healthcare to logistics and agriculture, profoundly influencing the global economy and society.

The origins of automation can be traced back to the early 20th century when industrialization began to take hold in many parts of the world. One of the most significant early milestones was the introduction of the assembly line by Henry Ford in 1913, which revolutionized manufacturing by drastically reducing the time it took to produce a single product. This era of industrial automation marked the beginning of a shift toward mechanized production processes, where machines took over repetitive and labor-intensive tasks, allowing human workers to focus on more complex and creative activities. However, it was not until the mid-20th century that the field of robotics began to emerge as a distinct discipline.

The development of the first industrial robots in the 1960s represented a major leap forward in automation. These early robots, such as the Unimate, which was introduced by General Motors in 1961, were designed to perform specific tasks in a controlled environment, such as welding or assembling parts on a factory floor. Unlike earlier forms of automation, which relied on fixed machinery to perform a single function, robots could be programmed to carry out a range of tasks, making them more versatile and adaptable to changing production needs. The integration of robotics into industrial processes led to significant improvements in productivity, quality, and safety, as robots could work faster, more accurately, and without the risk of injury associated with human labor in hazardous environments.

As automation and robotics have advanced, they have expanded beyond the confines of manufacturing to influence a wide array of industries. In healthcare, for example, robotic systems are being used to perform minimally invasive surgeries with unprecedented precision, reducing the risk of complications and speeding up recovery times for patients. Robotic prosthetics and exoskeletons are helping individuals with mobility impairments regain independence, while automated diagnostic tools are improving the accuracy and efficiency of medical testing. In logistics, automation is transforming the way goods are stored, retrieved, and transported, with robotic systems capable of navigating vast warehouses and delivering packages directly to customers' doors.

One of the key drivers of the current wave of automation and robotics is the integration of artificial intelligence (AI). AI enables robots to learn from their experiences, adapt to new

situations, and make decisions based on complex data inputs. This has opened up new possibilities for automation, allowing robots to perform tasks that were previously thought to be the exclusive domain of humans. For example, in the field of agriculture, AI-powered robots can analyze soil conditions, identify and remove weeds, and harvest crops with a level of precision that was once unimaginable. In customer service, AI-driven chatbots and virtual assistants are handling a growing number of interactions with customers, providing personalized responses and solutions in real time.

Despite the many benefits of automation and robotics, these technologies also pose significant challenges, particularly in terms of their impact on the workforce. As machines take over more tasks, there is a growing concern that human workers will be displaced, leading to widespread unemployment and economic inequality. This is particularly true for jobs that involve routine, repetitive tasks, which are the most susceptible to automation. For example, in manufacturing, many assembly line jobs have already been replaced by robots, and this trend is likely to continue as technology advances. Similarly, in sectors like retail and hospitality, self-service kiosks and automated checkout systems are reducing the need for human cashiers and sales assistants.

However, while automation and robotics may eliminate some jobs, they also have the potential to create new opportunities. As machines take over routine tasks, human workers can focus on more complex and creative activities that require problem-solving, critical thinking, and emotional intelligence—skills that are currently beyond the capabilities of robots. Furthermore, the development, maintenance, and programming of robotic systems require a highly skilled workforce, creating demand for jobs in fields like engineering, computer science, and AI research. The challenge, therefore, lies in ensuring that workers have the necessary skills to thrive in an increasingly automated world. This will require a concerted effort from governments, educational institutions, and industry leaders to provide training and reskilling programs that prepare workers for the jobs of the future.

Looking to the future, the potential of automation and robotics is vast. One of the most exciting areas of development is the field of collaborative robotics, where robots and humans work together in close proximity, each complementing the other's strengths

Another promising trend is the integration of the Internet of Things (IoT) with automation and robotics. IoT refers to the network of connected devices that communicate with each other and share data in real time. When combined with robotics, IoT can enable more sophisticated automation systems that are capable of responding dynamically to changes in their environment. For example, in a smart factory, IoT-enabled sensors can monitor production processes and send real-time data to robots, allowing them to adjust their actions based on current conditions. This level of connectivity and adaptability can lead to significant improvements in efficiency, quality, and sustainability.

In addition to technological advancements, there is a growing emphasis on sustainability in the development of automation and robotics. As the world grapples with the challenges of climate change and resource depletion, there is an increasing need for robots that are energy-efficient and made from sustainable materials. This has led to the development of new technologies, such as solar-powered robots and biodegradable materials, that align with global environmental goals. Furthermore, automation can play a key role in reducing waste and optimizing resource

use in industries like agriculture, where precision farming techniques can minimize the use of water, fertilizers, and pesticides.

While the future of automation and robotics is full of promise, it is important to recognize that these technologies are not without their challenges. One of the key obstacles to widespread adoption is the high cost of developing and deploying advanced robotic systems. Although the cost of robots has decreased significantly over the past few decades, making them more accessible to small and medium-sized enterprises, the initial investment required can still be prohibitive for many businesses. Additionally, there is a need for robust infrastructure and regulatory frameworks to support the safe and effective use of robots, particularly in industries like healthcare and transportation, where the consequences of failure can be severe.

In conclusion, automation and robotics are transforming industries and shaping the future in ways that were once the realm of science fiction. From manufacturing and healthcare to logistics and agriculture, these technologies are driving efficiency, improving quality, and opening up new possibilities for innovation. However, they also present significant challenges, particularly in terms of their impact on the workforce and the ethical and social implications of their use. As we move forward, it will be essential to address these challenges thoughtfully and proactively, ensuring that the benefits of automation and robotics are realized in a way that promotes a more equitable, sustainable, and prosperous future for all.

Research Publications

Enhancing National Logistics Policy using Radio Frequency Identification (RFID)

Adarsh Pandey, Alok Kumar

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

This research explores the integration of Radio Frequency Identification (RFID) technology into National Logistics Policy, aiming to enhance supply chain efficiency. The study assesses RFID's impact on inventory management, transportation, and overall visibility in the logistics network. Real-world case studies and simulations are used to gauge effectiveness, while addressing challenges such as cost, and interoperability. The paper offers practical strategies for overcoming these hurdles, providing insights for policymakers and logistics stakeholders. The adoption of RFID promises to significantly improve traceability, reduce operational costs, and elevate national competitiveness in the global market. This research serves as a foundational guide for policymakers seeking to modernize logistics policies through RFID integration, offering a pathway to a more resilient and technologically advanced national logistics infrastructure. This study creates a new supply chain procedure utilizing RFID after thoroughly examining the variations in supply chain operations without RFID. The result creates a new supply chain procedure utilizing RFID after thoroughly examining the variations in supply chain operations without RFID.

Experimental Performance Evaluation of Ice Slurry Refrigeration System using PG & EG Depressants

Arshlaan Siddiqui, Jatin Gupta, Aabhaas Bhatiya, Ujjwal Sahu, Atul Singh, Manish Mangla, Vaibhav Jain

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

The use of certain types of depressants is one of the primary contributors to global warming and ozone depletion, the demand for effective and sustainable cooling systems has increased the use of ice slurry as a promising substitute in a variety of applications. But there is still much work to be done to produce ice slurry effectively. To improve the formation of ice crystals, the process, and overall system effectiveness, this study report presents an experimental examination of a mechanical scraper ice slurry generator using ethylene glycol, and propylene glycol as depressants at three different percentages, namely 10%, 18%, and 25%. The study comprises the measurement of several parameters at various state points, such as mass flow rate, pressure, temperature, and enthalpy, as well as the computation of performance parameters, the link between slurry temperature and time, and a comparison of the system coefficient of performance (COP) at various concentrations. In this study, a –14.8°C temperature was attained for a 25% volume-by-volume aqueous solution of ethylene glycol, representing the lowest temperature recorded on our system.

Energy and Exergy analysis of vapor compression refrigeration system with integrated mechanical subcooling using R134a, R450a, R513a, and R515a

Kunal Singh, Dheeraj Joshi, Diptanshu Chowdhury, Naveen Solanki, Vaibhav Jain

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

This study compares the performance of a vapor compression refrigeration system (VCRS) with an integrated mechanical subcooled vapor compression refrigeration system (IMS-VCRS) in water-cooled centrifugal chillers. Specifically, in this study uses four different refrigerants R134a, R450a, R513a, and R515a. A mathematical model of an IMS-VCRS is provided to determine the performance parameters at a fixed cooling capacity of 1750 kW. This study investigates that the energy consumption of an IMS-VCRS is reduced by 11.36% for R134a, 11.98% for R450a, 13.36% for R513a, and 11.89% for R515a. The mechanical subcooled system's COP is increased by 12.84% for R134a, 13.59% for R450a, 15.40% for R513a, and 13.48% for R515a due to the low power requirement. In addition, exergetic analysis is also used to determine the system's second law efficiencies, which in this case improved by 11.25%, 11.84%, 13.41%, and 11.77% for R134a, R450a, R513a, and R515a respectively. Furthermore, parametric analyses were performed to investigate the effects of various system parameters such as evaporator and condenser temperatures.

Factors Affecting the Performance of Indian Aviation Industry

Homesh Saharan, Nikunj, Mandeep, Gaurav, Mayank Singh Negi, Garima Sharma

Recent Innovations in Science & Technology (RIST 2024)

This research is majorly focused on various factors that affect the performance of the aviation industry in India. This research analyzes various factors that contribute towards the overall success or failure or in business terms, loss or profit of an airline that operates on routes across India. The focus is to analyze the performance of this industry in the past one year and compare it to the post COVID-19 recovery phase. A framework showing how components are arranged at various levels and how one-factor impacts or is impacted by another is created using Total Interpretive Structural Modelling (TISM). The results of this study can be used for financial analysis and improvements in the field of aviation in India as it assesses the major and most important factors that play a vital role in profit or loss estimation of any airline.

Design and Optimization of Chassis and Drivetrain of Formula Student Vehicle

Aamir Chaudhary, Manan Garg, Nitin Pandey, Sarthak Sikka, Sushant Bharadwaj, Rakesh Chander Saini

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

This research paper aims to produce a clear idea about the types of Design and analysis to be run on a student formula chassis with the amount of load or G forces to be applied to it using Solid works software, to make sure that the driver is safe inside the cockpit. The overall scope of this project can be broken down into two objectives. The first objective of this report was to design, manufacture, and test a Formula SAE race car chassis; several factors will be considered, including vehicle dynamics, chassis rigidity, component packaging, and overall manufacturing and performance. Design and optimize the chassis system considering aesthetics, ergonomics and giving utmost priority to the driver's safety. For the design procedure, we have taken references for various SAE research papers. The CAD file is entirely developed on Solid works 2020-21. Also, we have tried to use Ansys 2021 2D structural analysis. The fabrication is done in house using Jigs & Fixture tables. We have used the TIG and Arc welding machine for welding purposes. The material used in overall frame design is AISI 4130 chromium, molybdenum steel alloy for maximum strength to weight ratio. And in addition to that, it has great weldability.

Enablers of Sustainable Supply Chain Management: Literature Review

Mayank Sahu, Dinesh, Atul Chaudhary, Alok, Govind, Piu Jain, Garima Sharma

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

Organizations are currently transitioning towards sustainable supply chain management (SSCM), thinking beyond economic benefit objectives, to solve the socioeconomic and environmental difficulties that their organization is experiencing as a result of globalization. More companies are devoted to the cause of sustainability in their supply chain due to restrictions from external sources and understanding of the potential rewards. Although difficult, there are important enablers that facilitate the transition to a sustainable supply chain. This study aims to identify and categorize the enablers that promote sustainable supply chain management.

Design and Fabrication of Automatic Screen Printing Machine

Nikhil Goyal, Harsh Pawar, Nischay Gautam, Satish Kumar

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

Screen printing is a technique of applying pressure of a certain quantity of coloring agent into a specified surface to form a text and a lot of development is taken place. Screen printing has applications in commercial printing, fabric printing, advertisement & lot more. A lot of innovation has been done to automate screen printing machines. We have introduced an automatic screen printing machine for small and medium-scale industries, which uses stepper motors controlled by Arduino board. The screen printing is done automatically by moving the squeegee to and fro with the help of rack and pinion gears. The main objective is to create a machine that is portable, cost- effective, and automatic.

Enhancement of heat transfer performance of a fin tube heat exchanger using modified delta winglet vortex generator

Akshay Sheoran, Pardeep Gahlot, Narender Kaushik, Sachin Gupta

1st International Conference on Green Technology and Sustainability (ICGTS-2024)

The heat transfer performance of a fin tube heat exchanger is played very important role for getting maximum performance. To obtain the maximum heat transfer performance used a lot of active and passive techniques by the researchers. In this paper the heat transfer Performance enhanced by using the modified delta winglet vortex generator. The rectangular plate dimensions are considered 300mm*200mm*4mm, in which 12 Thermocouples are fitted for measuring the effect of temperature and pressure difference. The colburn factor is further determined in relation to the Reynolds number with the aid of mathematical computations. As is well known, the performance of heat transfer is directly correlated with the colburn factor. The experimental procedure repeats two times, first without a winglet and the second time it is performed with a winglet. A comparison of heat transfer performance is to be done with or without the winglet.

Ranking of Enablers of Sustainable Supply Chain Management: An AHP Approach

Mayank Sahu, Dinesh, Atul Chaudhary, Alok, Govind, Piu Jain, Garima Sharma

Recent innovations in Science & Technology (RIST 2024)

Organizations are currently transitioning towards sustainable supply chain management (SSCM), thinking beyond economic benefit objectives, to solve the socioeconomic and environmental difficulties that their organization is experiencing as a result of globalization. More companies are devoted to the cause of sustainability in their supply chain due to restrictions from external sources and understanding of the potential rewards. Although difficult, there are important enablers that facilitate the transition to a sustainable supply chain. This study aims to identify and categorize the enablers that promote sustainable supply chain management.

Best Projects (2023 – 2024)

Designing and Fabrication of 6-Degrees of Freedom robotics arm

Parth Bhardwaj, Priyanshu Jain, Saheem Ahmad Khan
Project Guide: ***Dr. Garima Sharma***

This research paper explores the multifaceted realm of 6-degree-of-freedom (6- DOF) robotic arms, sophisticated machines that have redefined precision manipulation in diverse industries. With six independent parameters determining their configuration, these robotic arms offer a unique combination of translational and rotational movements, fostering adaptability crucial for intricate tasks. The paper investigates the kinematics, dynamics, and control mechanisms underlying 6-DOF robotic arms, unraveling the interdisciplinary synthesis of mechanical engineering, control theory, and artificial intelligence in their design. Through an examination of their design considerations, mathematical models, and real-world applications, the research aims to illuminate the transformative potential of these robotic systems. From industrial automation and assembly lines to medical surgery and space exploration, the versatility of 6-DOF robotic arms emerges as a catalyst for enhanced efficiency, precision, and safety in the era of automation. This exploration not only serves academic curiosity but also underscores the imperative of understanding and leveraging these robotic marvels to unlock their full capabilities in modern industries.

Factors affecting the performance of Indian Aviation Industry

Homesh Saharan, Nikunj, Mandeep, Gaurav, Mayank Singh Negi
Project Guide: ***Dr. Garima Sharma*** *Project Co-Guide:* ***Dr. Piu Jain***

This research is majorly focused on various factors that affect the performance of aviation industry in India. This research analyzes various factors that contribute towards the overall success or failure or in business terms, loss or profit of an airline that operates on routes across India. The focus is to analyze the performance of this industry in the past one year and compare it to the post COVID-19 recovery phase. A framework showing how components are arranged at various levels and how one-factor impacts or is impacted by another is created using Total Interpretive Structural Modelling (TISM). The results of this study can be used for financial analysis and improvements in the field of aviation in India as it assesses the major and most important factors that play a vital role in profit or loss estimation of any airline.

Brake-by-Wire technology for autonomous vehicles

R. Vignesh

Project Guide: ***Dr. Garima Sharma*** *Project Co-Guide:* ***Dr. Piu Jain***

With the development of vehicle chassis technology moving towards X-by-wire, the demand for distributed braking systems has intensified. High-level autonomous driving also necessitates higher response speeds and control accuracy for drive-by-wire systems. Brake-by-wire (BBW) technology, a critical component of modern high-performance and electrified vehicles, enables driver-independent vehicle dynamics control, such as brake torque blending, and the integration of advanced assistance functionalities like Emergency Brake Assist (EBA) and Electronic stability programme (ESP).

BBW technology is crucial for driverless cars due to its faster reaction time and improved stability, enhancing passenger safety. It eliminates traditional mechanical and hydraulic components in Favor of electrical signal transmission, offering significant advantages such as interior and exterior design flexibility for Original Equipment Manufacturers (OEMs).

However, the development and testing of these systems can be costly and challenging, particularly regarding gain tuning. To address these issues, a significant portion of testing is conducted in virtual environments during the concept phase, utilizing reliable models to simulate real-world conditions accurately. This study focuses on a brake-by-wire system mainly for electric vehicles.

The 15th IQ Automotive Braking System Europe 2023 conference was conducted in Germany that focused on Brake- by-Wire (BBW) technology. Tony Frenzel, the project director of the new braking system at Bosch, was the speaker, addressing the challenges and priorities of automotive braking systems.

Key objectives include designing a BBW mechanism compliant with ISO 26262 standards and performing functional testing on a drive-by-wire embedded system board. The pedal linkage is designed to achieve a mechanical force gain between the pedal and master cylinder. Assuming an average human force of 326 N on the brake pedal, an optimal pedal ratio without brake boosters is calculated to be 33:1, producing an output force of 1930.53 N. To address the issue of increased pedal length, brake boosters with a 9:1 ratio generating a vacuum of 8 psi are used, resulting in a pedal ratio of 3.7:1.

This proposal outlines a BBW system utilizing a DC brushed motor with a torque capability of up to 20 Nm. The system features a clutch cable with a 2 mm inner wire diameter and a motor-mounted pulley. The mechanical advantage is fine-tuned by adjusting the pulley diameter, achieving a brake cable efficiency of 84% ($\eta = 0.84$). The required force, compensating for brake losses, is 388 N, necessitating a torque of 15.4 Nm.

The proposed motor meets this requirement with a maximum continuous torque output of 20 Nm. This research contributes to the evolving field of BBW technology, presenting a feasible and efficient mechanism that enhances both vehicle safety and performance.

Internship Corner (2023 – 2024)

In the 7th semester curriculum, students embark on a crucial 4-week industrial training, four credits upon completion. In the academic year 2023-2024, 65 students completed internships with renowned companies like DRDO, Escorts, DMRC, Audi, Dabur India, Indian Railways etc. The internship details are given below:

S. No.	Enrollment No.	Student Name	Internship / Summer Training
1	00114808221	Manish Sharma	Maxim Metaltech PVT LTD.
2	00214808221	Tushar Aneja	Nirankari Engineering Works
3	00214811120	Aditya Gosain	AAR Academy
4	00314808221	Bhupender Singh Bisht	Guru Kripa Engineers Works
5	00414808221	Pawan Kumar Upadhyay	Maxim Metaltech PVT LTD.
6	00414811120	Ankur Ujjwal	CODSOFT (Data Science)
7	00514808221	Ankit Pal	Jaycee Steels Private Limited, Ghaziabad
8	00514811120	Anshul Mathur	Codsoft (Data Science)
9	00614808221	Abhishek Kumar	DRDO
10	00614811120	Aryan Girdhar	Napino Digital Solutions
11	00714808221	Anshu Yadav	Guru Kripa Engineers Works
12	00714811120	Ashish	Galaxy Toyota
13	00814808221	Aditya Kashyap	AUTOCAD, Computer Professional Group
14	00814811120	Chirag Gupta	Teachnook Bengaluru, Karnataka
15	00914808221	Ajay Kumar	DRDO
16	01014811120	Deepanshu Kumar Kadam	Galaxy Toyota
17	01114811120	Divyanshu	V K Enterprises
18	01214811120	Ehsas Srivastava	Udemy, Solid works
19	01314811120	Harsh Bhatt	Uboard India limited
20	01414811120	Harsh Goel	MP Heat

S. No.	Enrollment No.	Student Name	Internship / Summer Training
21	01514811120	Harsh Gupta	M-Tech Equipment
22	01614811120	Harshit Gupta	Shree Radhey Timber
23	01714811120	Himanshu Yadav	Escorts Kubota Pvt. Ltd.
24	01814811120	Kavya Taneja	Aerostars UAV Tech Pvt. Ltd.
25	01914811120	Kevin Devgan	GSI Logistics Pvt. Ltd.
26	02014811120	Laksh Aggarwal	Galaxy Toyota, Moti Nagar
27	02114811120	Love Kumar	Dynamic Elcpower Pvt. Ltd.
28	02214811120	Manan Singh Sethi	Parrytech Hydraulics
29	02314811120	Mohd Rashid Kausar	Kripa Automation Pvt Ltd
30	02414811120	Mohit Lakhera	Northern Railways, Sarai Rohilla
31	02514811120	Mrihnal Mahajan	V. K. Enterprises, Faridabad
32	02614811120	Neelesh Gore	Dabur India Ltd.
33	02714811120	Neeraj Sharma	S R enterprises
34	02814811120	Nihal Mahto	Kripa Automation Pvt Ltd
35	02914811120	Prakhar Jain	StepApp- Business Research and Content Writer, Mumbai
36	03114811120	Sagar Rawat	Luis n Vaya Pvt. Ltd.
37	03214811120	Saquib Khan	IIT Gandhinagar (Research Internship)
38	03314811120	Satyam	Pro Ideas Marketing Pvt. Ltd.
39	03414811120	Shashank Anand	DMRC, Delhi
40	03514811120	Shobhit Tyagi	Escorts Kubota Pvt. Ltd.
41	03614811120	Shrey Jain	Advanced Solidworks training at Ardee Machino Tools
42	03714811120	Shreya	Escorts kubota India pvt. ltd
43	03814811120	Shubham Goel	Genesys Projects & Associates Pvt. Ltd.
44	03914811120	Sparsh Jindal	Preeti Fibre Glass, Kanjhawala
45	04014811120	Syed Qasim Ali	Aquagreen Engineering Management Private Limited

S. No.	Enrollment No.	Student Name	Internship / Summer Training
46	04114811120	Tamanna Singh	Escorts Kubota
47	04214811120	Taniya	Escorts Kubota
48	04314811120	Tanmay Agrawal	Central Electronics Ltd.
49	04414811120	Uday Kalia	Baud Resources Pvt. Ltd.
50	04514811120	Vaibhav Chawla	Codsoft (UI/UX)
51	04614811120	Vaibhav Kumar	Insights Autotech Consultants
52	04814811120	Vansh Gulati	S R Enterprises
53	04914811120	Vansh Sahni	DMRC
54	20114811120	Ayush Kandari	Auto CAD, Internshala, Gurugram
55	20214811120	Abhinav Rana	Kripa Automation India Pvt. Ltd.
56	20314811120	Kunal Singh	Kripa Automation India Pvt. Ltd.
57	20414811120	Dheeraj Joshi	Kripa Automation India Pvt. Ltd.
58	20514811120	Adarsh Kumar Pandey	Central Electronics Ltd.
59	20614811120	Raushan Kumar	NIC- National Informatic Centre
60	20714811120	Tushar Solanki	Action Construction Equipment
61	35114808221	Saurabh Kumar	Guru Kirpa Engg. Works
62	35114811120	Laksh Dua	New Venus Car Pvt. Ltd.
63	35314811120	Ayush Dahiya	Action Construction Equipment
64	35414811120	Chaitanya Kotnala	AUDI India
65	35514811120	Diptanshu Chowdhury	Kripa Automation India Pvt. Ltd.

Alumni Corner

Routine overhauling of coaches in Indian Railway

Archit Karn

The Indian Railways is a stupendous sector which has a lot of work for the young aspirants who are quite inclined towards the technical field. Personally, I saw and observed numerous work which is done under the maintenance profile is pure technical and full of advanced systems. Railway is not confined to a certain lineage it has its widespread arena which is managed with proper and scrupulous management as safety is something which is literally an inevitable primary concern of Railway. New technologies like the replacement of the conventional coaches with LHB has been started very rapidly to meet the new advantages and benefits like less manufacturing cost with enhanced speed up to 160 km/h plus highly safe designed coaches.

Systems like Wheel Skidding and Sliding Protection (WSP)introduced in the coaches is itself a proper example of mechanical and automation work thus letting the coaches move more faster without confronting obstructions. The system of HOG to supply the electricity has led the reduction of cost by 25 percent in comparison to the EOG which uses diesel to generate electricity. In conventional ICF coaches source of electricity is alternator which converts mechanical energy into electrical. For AC coaches two alternators of 25KW power each are used in a single coach. For general coaches an alternator of 4.5 KW power, per coach is used. V – Belts and Pulleys, connects the shaft of the alternator to axle. 2×25 kW alternators for AC coach and 1×4.5 kW for non-AC coach is mounted underslung, driven by a pulley-belt arrangement when driving pulley is mounted on coach axle.

The suspension system has been improved a lot as the quainted system of suspensions which was based on the springs were used as whole changed into dampers which give a wonderful and comfortable ride by bearing the vibrations by absorbing it. Unlike steel spring, air springs retain their height under changing loads. The low natural frequency of air spring suspension remains virtually constant. In case of coil spring, deflection is proportionate to the load, therefore, under high payload situation, space constraint becomes critical, leading to the use of stiffer springs resulting in unsatisfactory ride behavior and reduced speed potential. Air springs through their control mechanism, offer a load proportionate stiffness, constant floor height and prospects of better ride behavior with higher speed potential.

The Axle Mounted Disc Brake System has been provided in LHB design Mainline Passenger Stock for Indian Railways. The brake system equipment provided on the LHB design coaches meet the requirement for high-speed trains hauled by locomotives and permits the emergency braking for such trains to be within the stipulated limits when brakes are applied on a straight

track at a speed of 160 km/ph with loco brakes.The brake caliper closes when the brake cylinder is actuated with compressed air. The brake pads come into contact with the brake disc, the braking effect begins.The axle mounted brake disc consists of a friction ring and a hub that are connected together and secured in place by nine screw connections. The axle-mounted brake disc which rotates with the wheel set axle is braked according to the pad.

SPECIFICATION: Dimension - 640 mm x 110 mm; Brake Radius 247 mm Type – Axle shaft mounted concentrically split, Material - Grey cast iron Friction ring wear (allowed) = 7 mm max. Weight =126 kg.Railway with incessant endeavors has brought a lot of changes in its system especially for the convenience of the passengers IR always strive out to look forward for upcoming technologies.

Industry Expert Corner

Implementing Sustainability and Circular Economy Practices in Manufacturing

Ankur Agnihotri
Deputy General Manager
(Marketing And Contract)
Jindal Saw Limited

The future of the manufacturing sector hinges on the adoption of sustainability and circular economy practices. The steel pipe industry, of which we are a part, is significantly affected by emissions. Recognizing this, we have embarked on a journey towards a more sustainable future. It is of utmost importance to pinpoint the primary sources of both direct and indirect emissions, which can include purchased goods and services, transportation, and the use of sold products throughout the supply chain process. Collaborating with relevant stakeholders and suppliers is crucial in assessing scope 1, 2, and 3 emissions using established methodologies. Currently, the top 500+ companies in India, in terms of market capitalization, are publishing BRSR and Sustainability Reports. They are setting clear targets, regularly reviewing progress, and redefining strategies for a better future. The implementation of sustainable practices in the manufacturing industry is not just a necessity, but an urgent requirement for our improved future.

Awareness and trainings shall be provided to all the employees in the process to achieve the Sustainable goals must be defined by the organization to Optimize processes to reduce and monitor energy consumption by taking take steps to Invest in solar, wind, Hydrogen or other renewable sources and must Monitor energy consumption and track progress. Additionally, organization should encourage circular Economy Practices such as Promote recycling, reuse, and waste reduction / management at manufacturing plants and offices and Encourage product life extension.

To meet the Paris goal of limiting global warming to 1.5°C, the world will almost certainly have to go carbon negative, taking a lot more carbon dioxide out of the air than is put into it. Nature-based solutions like planting trees and other land-use change can address part of the challenge, but the required quantities are so vast and the need for more durable solutions so crucial that technological solutions will be unavoidable hence Steel pipe industry is closely working towards development of pipelines for Carbon capture and store emissions. In carbon capture and utilization (CCU), the captured carbon dioxide is put to use. The carbon dioxide can be permanently locked up in a product (in construction materials, for example) or go into

a process (such as enhanced oil recovery, EOR). It can also be used and then emitted – for example through chemical conversion to make synthetic fuels, displacing fossil-fuel use.

Currently, North America accounts for over ⅔ (67%) of global CCUS capacity. Much of its carbon capture activities are found in Alberta, the U.S. Gulf Coast, and Midwest Going forward into this decade and the next, China and Southeast Asia will see the largest demand for CCUS. The biggest challenge, however, is the lack of regulatory and policy implementation for CCUS projects as Woodmac said. The rate of CCUS pipeline demand and growth is outpacing the government's ability to regulate.

In recent times, Hydrogen has emerged as a promising alternative energy carrier that can play a significant role in decarbonizing various sectors such as transportation, industry, and power generation. Hydrogen can be produced using renewable energy sources through processes like electrolysis, thereby generating "green hydrogen" with zero carbon emissions. However, to fully realize the potential of hydrogen as a clean energy source, there's a need for infrastructure development, including hydrogen pipelines. These pipelines would facilitate the transportation of hydrogen from production sites to consumption centres.

In conclusion, the manufacturing sector, particularly the steel pipe industry, is at a pivotal point in its evolution. The adoption of sustainable practices and circular economy principles is not just a choice, but an imperative for our collective future. As we navigate this path, we must focus on reducing emissions, optimizing energy consumption, and promoting recycling and waste management.

The journey towards a sustainable future is complex and challenging, but with concerted efforts and collaboration, it is a goal within our reach. Let's continue to work together for a better, more sustainable future.

Transition From a Student to a Professional

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It is a fantastic feeling to crack that Group Discussion, clear all those rounds of interviews and hold your first employment offer. Then, comes the time when the reality of the shift from a cool student life to a professional working life starts sinking in and that makes one excited, nervous, thrilled and terrified. As a HR professional, the anxiety and staggering are understandable. But one can overcome all these fears with a right approach and a positive mindset. In this candid article, we will be understanding how one can make this transition smooth and get their career off to the best start possible.

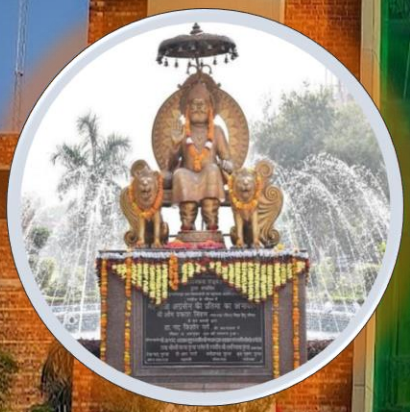
- **You've done this before**: Remember the feeling when you graduated from School and entered College with the same set of emotions, but you managed it effortlessly and now can't get over it. Adjusting to changes that come with starting your career is no different. Any change in our life is temporary in nature and then we adapt it in our routine and habits and make it a part of our being.
- **Accept the change:** Life will get different in pretty much every way. Your social life will be altered with early morning routine and office commuting. Many of you may have to shift their bases far from your homes for better opportunities but one must embrace all these changes as it will be a part of your personal growth. And, all these changes will be worth when you'll witness yourself transforming into a professional.
- **Your first job doesn't define your career:** This will be the first stage of your career and there may be a possibility that you feel this company and culture isn't what you wanted. Absorb as much as you can from the role and move on to next company. Always remember that you will have a wealth of experiences ahead of you and this is just the beginning. Treat every experience and role as a learning stone as these will shape your personality and guide you professionally.
- **Patience & Perseverance is the key:** There is a possibility that at the onset of your job, your seniors may involve you in admin-based jobs or relatively less important jobs but don't feel dejected or demotivated as this may be an assessment of your competency, perseverance and personality. And, as you will move up the career ladder, you will be bestowed with higher responsibilities and critical tasks. So, be patient and keep yourself motivated during this process.
- **Ask questions**: Many of you must have excelled in your student life and have gained intensive knowledge on subjects but when you enter real Corporate World, you will realise that it isn't enough. At that point, keep the confidence high and don't be afraid to ask questions as moving ahead with lack of clarity shall not serve any purpose. Mostly, seniors appreciate employee who ask for clarifications and are curious to gain

knowledge. Always share your ideas with the team as the young talent is warmly welcomed for bringing in the new perspectives and fresh energy on the table.

- **Have a realistic vision:** On an average, one spends more than 80,000 hours working over his/her career. Therefore, make sure that the work you do is worth it. For this, plan your vision and strive for the best jobs with the best employers by channelising your competencies, interests and passion.
- **Be a people person**: The best part of working in Corporates is that one tends to get acquaintance with multiple people with different personalities. Some of them will match your energy, some of them will intimidate you and some might be a major turn-off but all of them will give you experiences in life. The Corporate culture is unique in this regard as surprisingly, you may become great work buddies with someone double your age and on the other hand you may not get along with someone who shares your Birth Year. Be ready for all these exposures and remember all the people you meet in your journey will play a role in your growth story.
- **Hone your Corporate etiquettes:** To create a lasting impression, one needs to understand the accepted behavior, manners and protocols in a Corporate setting. Though some of them may vary as per the organizational setup but to foster a respectable workplace and amicable work environment, effective communication, respecting your seniors and colleagues, good interpersonal skills etc. are vital in nature.

To conclude this, every individual has a different corporate journey based upon their own experiences and exposure. I hope these pointers will guide you well for the Corporate World and help you craft your own successful career path.

Maharaja Agrasen Institute of Technology



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