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Impact of Artificial Intelligence on Mechanical Engineering

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Abstract: Traditional methods in mechanical engineering are being revolutionized by artificial intelligence (AI). The substantial effects of AI on design, production, and maintenance procedures are examined in this research. Engineers can produce optimal designs more quickly and effectively with AI-powered design tools, which enhances product performance and speeds up development cycles. AI improves accuracy, lowers waste, and streamlines production processes in manufacturing. Additionally, early fault identification made possible by predictive AI systems in maintenance lowers maintenance expenses and equipment downtime. These developments propel the development of mechanical engineering in a quickly changing technology environment by improving operational efficiency and opening the door for creative solutions. This AI integration demonstrates how it may raise productivity and change industry norms

Keywords: artificial intelligence

I. INTRODUCTION

Mechanical engineering is one of the many industries throughout the world that have been profoundly impacted by artificial intelligence (AI). AI is revolutionizing conventional methods, opening up fresh avenues, and producing creative answers. Its incorporation into mechanical engineering is changing manufacturing procedures, design approaches, and operational effectiveness.

Mechanical engineering has historically optimized machinery and systems using mathematical models, empirical data, and physical principles. But thanks to AI technologies, machines can now learn from enormous datasets, model intricate situations, and decide for themselves. Because of this paradigm change, engineers can now accomplish goals that were previously impossible to accomplish with conventional techniques.

Intelligent perception, pattern recognition, image processing, and virtual reality are just a few of the fields in which AI has made advances. AI improves accuracy, cuts waste, and streamlines processes in production. By anticipating possible faults, AI-powered predictive maintenance lowers operating costs and minimizes downtime. Additionally, engineers can produce optimized designs more quickly and efficiently thanks to AI-powered design tools. AI's contribution to mechanical engineering has been further enhanced by mechatronics advancements, which have integrated intelligent systems into conventional procedures. Automation powered by AI transforms project execution, increases productivity, and enhances product quality. AI encourages creativity and pushes the limits of mechanical engineering by mimicking intelligent behaviour.

The use of AI represents a significant shift, giving engineers the means to envision, plan, and carry out projects in previously unattainable ways. In addition to increasing efficiency, this evolution opens the door for revolutionary developments in industrial and mechanical applications.

II. WHAT IS AI?

The goal of the computer science field of artificial intelligence (AI) is to build machines that are able to carry out tasks that normally call for human intelligence. Learning, reasoning, problem-solving, perception, decision-making, and language processing are some of these tasks. Fundamentally, artificial intelligence (AI) is based on models and algorithms that let computers learn, interpret data, and come to wise conclusions.

AI can be broadly divided into two categories: general AI and narrow AI. Weak AI, sometimes referred to as narrow AI, is best at certain tasks, such facial recognition software or voice assistants like Siri and Atexa. On the other hand, general artificial intelligence (AI), sometimes referred to as artificial general intelligence (AG), aims to mimic human

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intelligence so that machines may carry out any intellectual work that a human can. Narrow AI has already made major strides in a number of areas, but general AI is still being researched.

Important AI Techniques :

Machine learning, deep learning, natural language processing, and robotics are only a few of the many technologies that make up,

Artificial intelligence (AI):

A branch of artificial intelligence called machine learning (ML) allows computers to learn from data and enhance performance without the need for explicit programming. ML algorithms use previous data to find trends and forecast outcomes.

Deep Learning (DL): A sophisticated type of machine learning that uses multi-layered neural networks to examine large datasets. It is extensively used in voice and picture recognition.

Natural language processing (NLP) : Enable robots to comprehend, interpret, and produce human language. Applications for sentiment analysis, language translation, and virtual assistants are all powered by NLP.

Robotics: AI-driven robotics uses machines to carry out automated and decision-making tasks. Industrial automation, healthcare, and service applications all make substantial use of robotics.

AI in the field of mechanical engineering :

Design, analysis, and manufacturing processes have been redefined by the combination of artificial intelligence and mechanical engineering. Engineers can now simulate complicated scenarios, learn from data, and improve systems like never before thanks to AI-driven methodologies that have brought previously unheard-of levels of efficiency, precision, and flexibility.

Manufacturing has undergone a transformation because to AI-powered robotics and autonomous systems, which have increased efficiency and flexibility in procedures like robotic assembly lines and automated material handling. These systems are essential to contemporary industry because of their exceptional intelligence and versatility.

Applications in Various Industries :

Healthcare, banking, transportation, and entertainment are among the areas that are changing as a result of AI technology. AI improves agility and flexibility in manufacturing, and it helps with individualized medicine and diagnostics in healthcare. The broad use of AI in many industries demonstrates how it may spur innovation and enhance societal results.

As artificial intelligence (AI) develops, its application to mechanical engineering and other domains will open up new avenues for innovation and redefine industrial norms.

III. AREAS AI CAN BE DEPLOYED IN MECHANICAL ENGINEER FIELD

The application of artificial intelligence (AI) in mechanical engineering is revolutionizing conventional methods and providing game-changing advantages for a range of uses. AI is having the following effects on this field:

Design and Enhancement :

AI gives engineers the ability to improve and automate the design process. Large datasets can be examined using machine learning algorithms to produce optimal design options, forecast performance results, and suggest parameter changes. This guarantees greater design precision, shortens product development durations, and speeds up innovation cycles.

Predictive Maintenance :

Mechanical engineering relies heavily on maintenance, and AI's predictive powers are transforming this field. Realtime sensor data is used by AI-powered systems to track the condition of equipment, spot any problems, and facilitate preventative maintenance. This method prolongs equipment life, minimizes downtime, and avoids expensive repairs.

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Manufacturing Automation :

Smart technologies and robotics powered by AI are increasing production efficiency. AI-enabled robots carry out tasks with accuracy and flexibility, increasing output rates and guaranteeing quality control. Automation increases overall productivity by streamlining material handling and assembly procedures.

Integration of IoT and Smart Systems :

In mechanical systems, artificial intelligence (AI) improves the capabilities of Internet of Things (IoT) devices. In order to forecast abnormalities, optimize operations, and regulate inputs, machine learning examines sensor data from linked devices. Better efficiency and smoother integration between intelligent systems result from this.

Modeling and Simulation :

Engineers can use AI to model intricate procedures and forecast results prior to actual production. Time and money can be saved by using machine learning algorithms to model electromagnetic phenomena, fluid dynamics, and structural evaluations. These simulations offer insightful information about how to improve procedures and designs.

Systems for Supporting Decisions :

Engineers may make well-informed, data-driven decisions with the help of AI-powered technologies. AI helps with process optimization, resource allocation, and project management by evaluating datasets, finding trends, and making recommendations. This improves overall efficiency.

Natural Language Processing (NLP):

Applications of natural language processing (NLP) aid in knowledge sharing, automating documentation, and gleaning insights from technical literature. Workflows are streamlined, and teams benefit from improved access to vital information.

Innovation and Generative Design

AI explores previously unachievable design possibilities, opening up new creative horizons. Businesses may push the envelope, find ways to cut costs, and reduce waste via generative design algorithms.

Safety in the Workplace and Quality Control

AI is used in manufacturing to discover flaws and examine products for quality. By automating dangerous or repetitive operations and detecting risks, these technologies improve worker safety.

Systems that are Mechatronic

AI is essential to the development of mechatronic systems, which combine electronic and mechanical parts. By bridging the gaps between modern technology and ancient mechanics, this transformation is making systems smarter and more efficient.

In addition to changing particular procedures, the application of AI in mechanical engineering is reinventing entire industries, encouraging creativity, and increasing productivity. This development represents a paradigm change that will continue to influence engineering and production in the future.

IV. CONCLUSION

Mechanical engineering is undergoing a dramatic change as a result of the quick development of AI in the digital age, which redefines established procedures and creates new opportunities. From manufacturing automation to predictive maintenance, AIpowered solutions have demonstrated their capacity to improve product design, streamline operations, and transform engineering methodologies. Businesses can obtain deeper insights and increase project precision, dependability, and innovation by utilizing AI. This makes it possible for engineers to push the envelope of what is feasible and solve complicated problems more effectively. But as AI's impact grows, it is imperative to address related issues like labor adaptation, ethical concerns, and changing legal needs. Adopting AI pensibly would promote

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innovation and prosperity while guaranteeing long-term improvements that benefit communities, businesses and society at large.

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