SUGISAKA MASANORI

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Research Article

Usage and Distinctions of Robotic Arms, Conventional Machinery, and Hands-on Labor in Manufacture Processes

Xue Yang, Yuping Mei, Ying Su
College of Electronic Information and Automation, Tianjin University of Science and Technology, 300222, China

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ABSTRACT

The purpose of this article is to delve into the contrasting characteristics of robotic arms as opposed to conventional machinery and human capabilities.First of all, robotic arms represent a type of automated tool that exhibits high accuracy and flexibility, enabling them to execute a wide range of complicated tasks. Conversely, conventional machines are often short of such high accuracy and flexibility, while human-beings tend to suffer from issues like high error rates and low work efficiency. Second, the advent of robotic arms offers a solution to numerous challenges posed by conventional machines and human-beings, ultimately enhancing manufacture quality and efficiency. Lastly, what there is not have inherent conflicts between robotic arms, conventional machines, and human-beings; instead, one can effectively complement to another one. Throug strategically integrating robotic arms and human labor, we human can harness their respective strengths to optimize economic gains and overall manufacture efficiency.

1. Introduction

Robotic arms embody a form of advanced automation that excels in adaptability and precision, capable of executing intricate tasks with ease. Conversely, traditional machines often fall short in terms of flexibility and precision, while human operators, though versatile, may struggle with reduced work efficiency and heightened error probabilities.

The advent of robotic arms presents a transformative solution to numerous challenges faced by both traditional machinery and human labor, offering enhancements in both production efficiency and quality standards that surpass previous capabilities.

There exists no inherent conflict between robotic arms, conventional machines and human-beings; rather, they have the potential to complement each other effectively. Through the rational utilization of both robotic arms and human labor, we can maximize their individual strengths and ultimately enhance economic gains and overall manufacture efficiency.

The article proceeds as follows: Section two highlights the distinct visual contrasts between robotic arms and conventional machines. Section three explores how robotic arms revolutionize manufacturing by resolving myriad issues. Lastly, section four underscores the symbiotic relationship between robotic arms and human labor. Concurrently, robotic arms shown in Fig. 1 necessitate human management and supervision to make sure their seamless operation and uphold manufacture safety standards. As technology continues to advance and evolve, robotic arms are poised for extensive application and development across diverse fields in the future.

Fig. 1 A depiction or illustration of the robotic arm

Corresponding author E-mail: wybzdwzdbzd@126.com

2. The Different Appearances

Machine arms and traditional machines have distinct differences in appearance.

2.1. Conventional machines

Conventional machines are commonly characterized by a sturdy, inflexible construction made up of diverse metallic and plastic elements and components, with their form and dimensions remaining relatively constant, rendering them suitable only for large-scale production and processing within factory settings.

An image portraying the traditional machines is presented in Fig. 2.

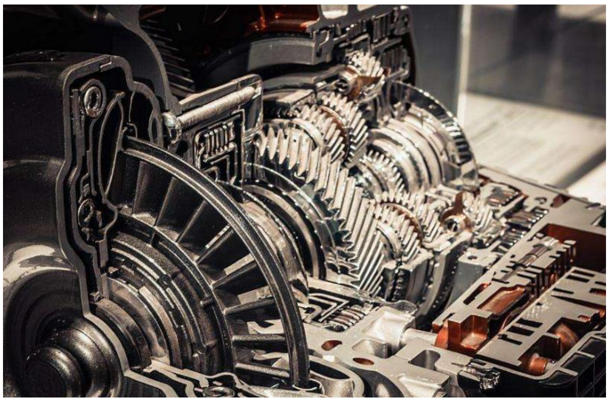
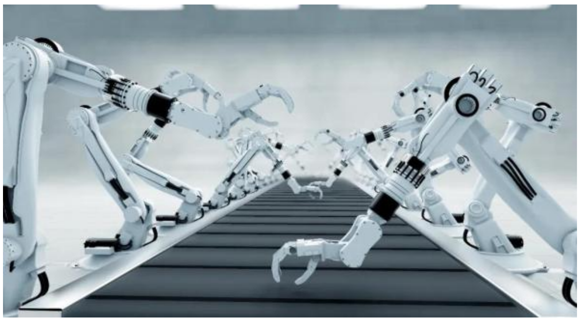


Fig. 2 An image of the conventional machines

2.2. Robotic arms

The architecture of robotic arms commonly embraces a versatile mechanical framework, incorporating numerous articulated joints and limbs, coupled with a range of sensors and actuators at their termini. These joints and limbs possess individual mobility, enabling the robotic arm to adapt seamlessly to diverse operational scenarios and tasks. Furthermore, robotic arms are frequently furnished with a variety of sensory devices, including vision sensors, touch sensors, and force transducers, which facilitate precise perception of the ambient environment and the execution of intricate maneuvers.

The depiction of the robotic arms is displayed in Fig. 3.



Fig, 3 An image of the robotic arms

Conventional human-driven production methods have struggled to maintain baseline standards, potentially resulting in a dwindling of economic efficiency and productivity [1]. Hence, robotic arms exhibit greater flexibility, intricacy, and intelligence in comparison to conventional machinery, offering a marked distinction in their physical manifestation.

3. The Usage of Robotic Arms

The implementation of robotic arms within manufacturing settings presents viable resolutions to numerous challenges. Below is an elaborate exploration of specific applications and benefits that robotic arms confer to the manufacturing industry.

3.1. Replacement of Hazardous and heavy work

Within the manufacturing sector, a plethora of arduous, physically demanding, and repetitive duties pose risks to employees' wellbeing, both physically and mentally. The employment of robotic arms serves as a solution, as they can undertake these hazardous and strenuous tasks, eliminating the need for human involvement in dangerous environments and alleviating workload. For instance, in automotive production, robotic arms are deployed for heavy lifting, welding, and painting operations, which are inherently perilous, thereby safeguarding workers from occupational hazards and minimizing the risk of work-related injuries.

3.2. Increasing production quality

The impeccable precision and relentless repeatability inherent in robotic arms surpasses human capabilities in executing manufacturing tasks. Leveraging pre-programmed instructions or advanced sensor technology, these robotic arms guarantee uniformity and superior product quality throughout the production cycle. On assembly lines, robotic arms meticulously assemble and secure components, ensuring that every product adheres to stringent specifications and quality benchmarks, thereby enhancing overall product consistency and reliability.

3.3. 24-hour uninterrupted work

Robotic arms possess the ability to operate relentlessly, devoid of the need for rest or sleep, enabling them to function continuously for 24 hours straight. This uninterrupted operational capacity significantly enhances production efficiency and accelerates production cycles. In stark contrast, humans necessitate periods of rest and recovery, limiting their ability to maintain continuous work over extended durations. Consequently, robotic arms become invaluable assets in scenarios that demand high-volume production and swift manufacturing processes, as they seamlessly fulfill these requirements without interruption.

In essence, the integration of robotic arms in manufacturing addresses numerous challenges, such as substituting hazardous jobs, elevating production quality, facilitating round-the-clock operation, and bolstering both production and economic efficiency. As technology continues to advance and mature, the application of robotic arms is poised to broaden significantly, introducing further innovations and substantial value to the manufacturing sector, thereby transforming and enhancing its capabilities.

4. The collaboration

4.1. Collaboration between robotic arms and traditional machines

Robots, being highly automated and meticulously precise, excel at executing repetitive physical chores with consistency. Conversely, traditional machines offer versatility, capable of tackling a broader spectrum of tasks. By fusing these two technologies, we can forge a production line that is both efficient and adaptable.

In the realm of manufacturing, this collaboration manifests as traditional machines handling intricate processing duties, while robotic arms take on the repetitive tasks like material handling, assembly, and quality inspection. This strategic partnership enables each technology to capitalize on its unique strengths, ultimately boosting overall production efficiency. Furthermore, this integration can also lead to cost savings by substituting human labor with robotic arms in hazardous or physically demanding roles, thereby minimizing human resource dependency and associated expenses.

4.2. Cooperation between robotic arm and human

The collaboration between robotic arms and humans encompasses two distinct facets: human-machine interface and robotic augmentation of human capabilities.

Human-robot interaction entails a scenario where a robotic arm executes tasks under human direction. In this paradigm, individuals can steer the robot's actions via command inputs or direct manipulation, allowing for a harmonious partnership in tackling hazardous or physically demanding jobs, like underwater missions or space exploration. This mode of collaboration fosters the best of both worlds, leveraging human creativity and adaptability while mitigating exposure to risk.

On the other hand, machine-assisted human labor signifies the utilization of robotic arms as a supportive technology to enhance human performance in complex undertakings. A prime example lies in the medical domain, where robotic arms assist surgeons, enhancing surgical precision and efficiency. This type of collaboration relieves humans from arduous or intricate tasks, thereby augmenting work productivity and quality, fostering a more streamlined and efficient work environment.

The illustration depicted in Fig. 4 showcases a harmonious collaboration between a robotic arm and a human operator, exemplifying the synergy between advanced automation and human expertise.

Fig. 4 The image of the cooperation between robotic arm and human

Essentially, robotic arms, traditional machinery, and human labor coexist in a complementary, not contradictory, relationship. When deployed judiciously, they can synergize their unique strengths, fostering a boost in overall production efficiency and economic gains. Looking ahead, as technological advancements continue to shape our world, this collaborative paradigm will become increasingly prevalent and vital, marking a future where human ingenuity and robotic precision intertwine seamlessly.

5. Conclusion

Extensive research has illuminated that robotic arms, traditional machinery, and human labor do not clash but rather converge in a collaborative framework that enhances overall production efficiency and economic outcomes. This synergy underscores the potential for these entities to work together seamlessly, maximizing their individual strengths for mutual benefit.

In conclusion, robotic arms, traditional machinery, and human labor each possess distinct advantages and limitations, catering to diverse production contexts. As technology evolves and innovates, we envision harnessing these strengths to elevate production efficiency and economic returns. Concurrently, we must prioritize strategies for optimal human-machine integration, prioritizing safety, and ensuring product quality remains paramount.

The depiction of the harmonious integration between humans and machines is captured in Fig. 5, showcasing the potential of this collaborative effort.

Fig. 5 The depiction of the human-machine collaboration

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Authors Introduction

Ms. Xue Yang

She is currently pursuing her academic endeavors at the prestigious College of Electronic Information and Automation within Tianjin University of Science and Technology, situated in China. Her intellectual curiosity and dedication are particularly focused on the fascinating realm of robotic arms and their myriad applications.

Ms. Ying Su

She is enrolled at the esteemed Tianjin University of Science and Technology, where she is delving deeply into the captivating field of Robotics Engineering. Her enthusiasm and interest lie specifically in the realm of drone technology, where she seeks to explore the possibilities of these remarkable machines.

Ms. Yuming Mei

At the Tianjin University of Science and Technology, she has embarked on an exciting academic journey, majoring in Robotics Engineering. Her keen interest in the innovative world of drones propels her forward, as she delights in the prospect of uncovering their full potential and pushing the boundaries of this rapidly evolving technology.