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Research Paper on the Application of Robot Welding Technology

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ABSTRACT

Applications of robotic welding technology are analysed in Welding Applications. Importance, application, strengths and weaknesses are analysed in this welding procedure. The main weld types analysed are electron beam welding, ultrasonic welding, high frequency induction welding, arc welding, resistance welding, and applications of robotic welding technology are analysed. Here, these welding techniques are analysed for their application process and benefits of use. While explaining this process, we will also explain the process of welding technology and analyse how robotic technology is applied. The main type of robot analysed to perform this welding process is the 6-arm robot. The arms that control the welding from start to finish are explained for each type of welding.

KEYWORDS

Robot Welding Technology, Six Arm Robots, Electron Beam Welding, Ultrasonic Welding, HighFrequency Induction Welding, Electric Arc Welding, Resistance Welding

INTRODUCTION

Robotic welding technology is the latest technology being developed and implemented in the industry using different programming codes and different electrical circuits. It automates the welding process and handles all tasks from the welder to forming new components. These robots are designed to perform complex welding tasks such as resistance welding and arc welding. Use previously developed programmable code to control all robot actions and movements to automate industrial processes in welding technology. This robotic technology is used to improve the productivity and accuracy of product development in industry.

ROBOTIC WELDING TECHNOLOGY

Robots used in the welding process consist of multiple mechanically programmed tools that help automate the welding process in industry. This type of robot is used to automate welding techniques developed and used in industry to join two material components by increasing their melting point temperature (Hong et al. 2019). This technique is used for resistance spot welding and arc welding, which are most commonly used in the industry. The most commonly used type of robot in industry is the 6-axis industrial robot, which includes a 3-axis lower arm and a 3-axis wrist arm.

Six- axis industrial welding robot

APPLICATIONS OF ROBOTIC WELDING TECHNOLOGY BELOW ARE APPLICATIONS OF ROBOTIC WELDING TECHNOLOGY

1) Robotic Welding Technology is used in industry to automate the welding process. This automation is done using mechanically programmable codes, which are shaped to control the motion of the robotic arm and structure during the welding process (Chen et al. 2021). If the mechanism of the manufacturing process is continuous and the same, it can be easily replaced by the robot technology used and implemented in industry.

2) This robotic welding technology saves time in the welding process. If the welded manufacturing process is continuous and follows the same manufacturing process, the process also takes time to perform human skill in the industry (Xu et al 2020). This robotic welding technology intervenes with the help of developed programs and codes, whose movements are fixed and performed by the robot in a short time.

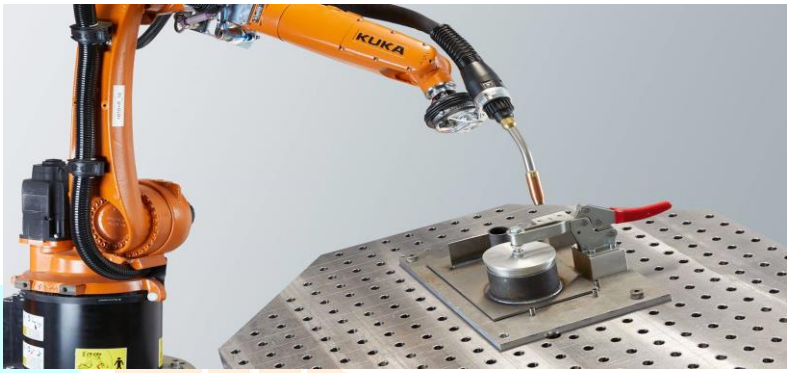
3) Robotic welding technology is widely used in the automotive industry. Arc welding, spot welding and resistance welding are mainly used here. Spot welding and resistance welding use electrical current with resistance to perform the welding process (Pashkevich et al 2019). Here, electrical energy is used to heat the object, so the object begins to melt after the temperature reaches its melting point. A robotic arm is used to correctly place different equipment and material components in the right place to carry out the welding process, after which the welding process is also carried out. It controls all the activities of the welding process, from the initiation of the weld, to raising the required melting point, to the final welding of the body components and their final joining.

4) Robotic welding technology is also used in arc welding, which uses an arc to carry out the welding process. An inert gas such as argon is used here to prevent the final product from reacting with the external atmosphere. All these processes from setting up equipment and tools to finishing the final welding process are controlled using a robotic arm (Ribeiro et al. 2019). The robot's actions are fully programmed and controlled, so there is little chance of error during the manufacturing process and it runs very quickly.

5) 6-axis industrial robots are used to perform arc welding processes in industry. This welding process includes a complete electrical circuit and power setup from the beginning. The welder's main task here is to control the workpiece and the torch during operation. This will deliver the shielding gas to the right place. This process is very slow even with skilled workers, but very quickly with robots. The role of the robot arm here is to control the movement of the welding torch and workpiece to the correct position during the welding process.

6) Laser welding is a process in which the energy emitted from laser light is used to perform a welding operation. The laser light is provided between two materials Parts that require welding. These components are fixed in place and only the movement of the laser cannon between the two components occurs here. This process increases the temperature between the two components and when that temperature reaches the melting point, a molten pool forms between the two components, which upon solidification permanently bonds the two material components together. Here, the use of a robotic arm serves only to control the reciprocating motion of the laser gun between the two components and stop the delivery of laser light after the welding process is completed.

7) Arc welding is the most common type of welding used in industry and is done with the aid of robots. This type of welding is mainly used in the automotive industry and is intended for large-scale and high-precision welding of automotive parts.



Arc welding industrial robots

Auto parts manufacturing processes are used for mass production where a large number of parts need to be produced. Here his 6-axis robot is used to carry out the arc welding process and is also used in large numbers. This has the advantage of saving time and increasing productivity in the industry by reducing the chance of errors during production.

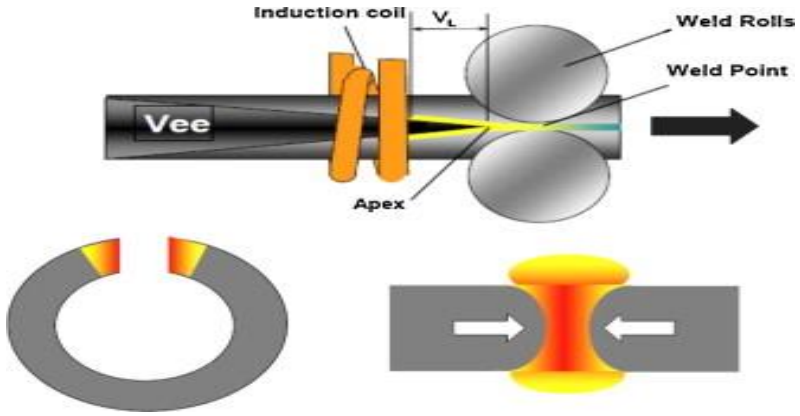
8) Robotic welding technology is also used in the small parts manufacturing industry, including the manufacture of electrical appliances and some mechanical parts. Friction welding is also used here to join any two small components using the thermal energy generated by the friction between the two components (Wang et al 2020). Here, components move back and forth on other components at high speed, creating friction between them and also creating hot zones. After the material reaches its melting point, it chemically melts the lower part of the part in contact with other parts. During coagulation, these two components are brought together and this process is performed very quickly and precisely using a robotic arm. This also creates welded joints with uniform surfaces and no defects.

9) The welding process is automated with the help of industry robotics technology that helps reduce manufacturing time, increase productivity and increase production efficiency. The most commonly used industrial robots are six-armed robots that are useful in manufacturing arc welding, spot, resistance, and friction welding processes.

10) The greatest use of this technology is found in the automotive sector. This is because here many parts and components have to be rejoined by a welding process, requiring a high level of precision when performing the welding process (Dahari et al 2019). A robotic arm is used to control the activities of the welding process. This also includes control of equipment movement and welding torches. It controls all welding processes from the start of the welding process to the end of the welding process.

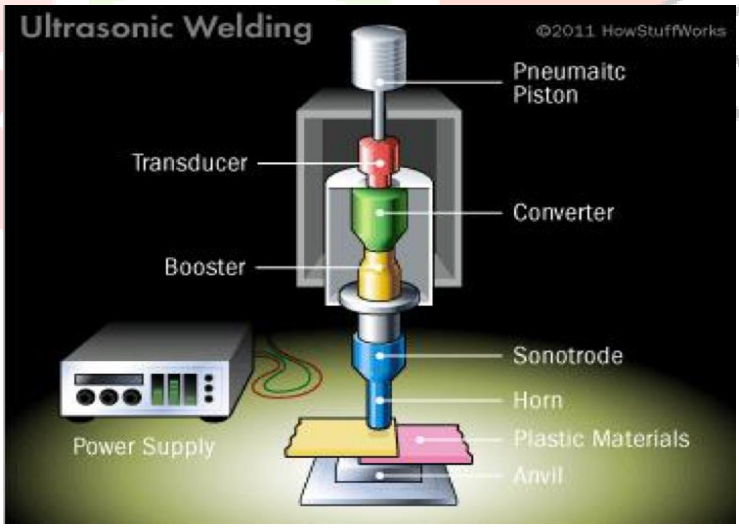
11) Robotic welding technology is also used in high-frequency induction welding in industry. This high-frequency welding technique is used to create very high-strength welds and is useful in manufacturing components and parts for the automotive industry. This technique is used to join welded joints using high frequency electromagnetic force. The material is heated and impacted in a high pressure area, causing portions of the material to melt and bond to form a molten component (Benakis et al. 2019). Robotic welding technology is used to carry out this welding process and control all its activities. In this case, the surface of the material is less likely to develop defects because heat is not generated in the outer body of the material. After the cooling process, the welded part solidifies and these two material parts are connected to form the welded part. This process produces very strong welds that last very long even in high pressure and high temperature environments. Using this welding process has many advantages, including: B. Fast welding process, cheap tools, and clean manufacturing process. Important factors affecting the welding process are applied pressure, welding time, power consumption, and solidification time (Huang et al. 2018). High-pressure welding is performed using a high-frequency generator to supply high-frequency power. This high frequency increases the energy input to the welding process, which improves the welding time and its formation

the external force applied to the above welding materials is caused by friction and heat generation between the materials. This also causes melting and fusion of material between the formed metal pools, which leads to the formation of the welding process. Robotic technology is used to control all activities of the welding process, from initiation of welding to completion of the welding process. Using robotic welding technology, the device is powered to weld and apply a force to the material body (Horváth et al. 2018). The technology is very fast, so this process results in high speed welding technology while increasing efficiency.



High frequency induction welding process

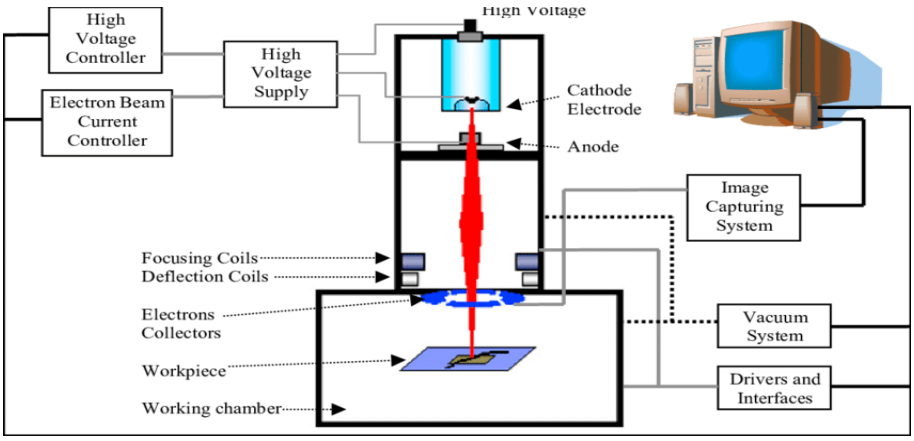
12) Robotic technology is also used in ultrasonic welding, a welding process that uses ultrasonic vibrations above 20,000 Hz. This technology is used to improve the speed and accuracy of the welding process. The types of equipment used here in the welding process are generators, converters, boosters, horns and anvils. These devices perform the welding process under the action of ultrasonic vibrations (Banga et al 2021). A generator is used to power a transducer device that is also used to convert the electrical energy received from the generator into ultrasonic mechanical vibrations. This ultrasonic vibration causes the horn attached to the low power transducer to reciprocate in the range of approximately 20,000 Hz to 30,000 Hz. This vibration is transmitted through a booster device, which amplifies the vibrations produced within the body. This horn provides continuous reciprocating motion to the material placed on the anvil. The plastic parts melt with the thermal energy generated by the friction process, which triggers the welding process (Kangru et al 2019). A weld pool is formed on the material so that the part melts and the material components are welded together during solidification. Robotic technology is used to perform the welding process with the help of a robotic arm that is used during the welding process (Farkas et al 2018). Robotic arms are used during the manufacturing process to turn power on and off and to control the position of materials placed on the anvil that need to be welded.



Ultrasonic welding technology

13) Robotic welding technology is used to perform an electron beam welding process where the material is placed on the anode and current is supplied from the cathode during the welding process. Current is continuously supplied from the cathode, from which a high voltage current is conducted to form an electron beam during the welding process (Zych et al. 2021). A deflection coil is used to deflect the direction of the electron beam formed by the cathode. A coil is also placed in between to generate an electromagnetic field. A vacuum pump is used to extract the scrap produced during the welding process. As the electron beam is placed in the space between the two material components, higher thermal energy is generated between them, melting the material between them and solidifying the two material components together (Gullino et al. al 2019). This welding creates a strong bond between them, forming a permanent welding process. It uses robotic welding technology to guide an electric beam between material components. This technology also controls the extraction of waste material during the formation of material welds. Robotic welding technology is used to perform this welding process in the shortest

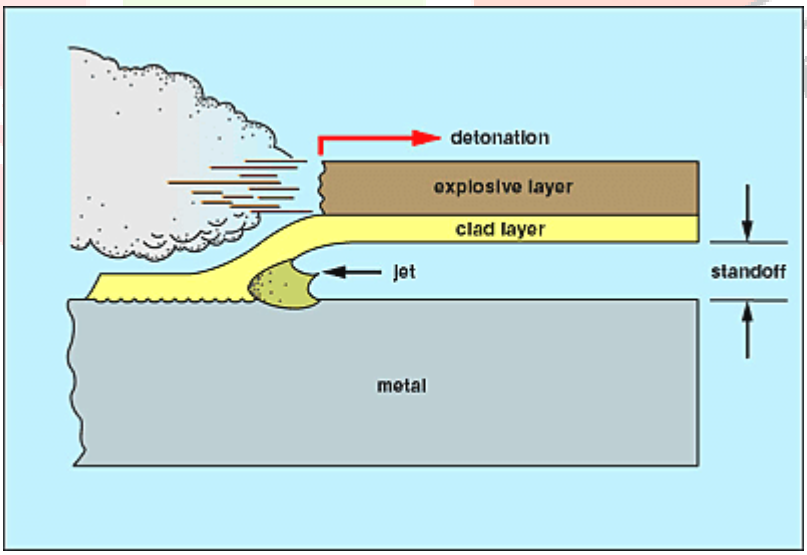
possible time and with greater accuracy. Coding and programs are used to instruct the robot to perform certain types of operations used during the welding process.



Electron beam welding technology

14) Using robotic welding technology to improve weld pool and weld joint formation more accurately and prevent material breakage during application. Various types of robots are used in manufacturing processes, but the most famous of these robotic technologies is his six-armed robot (Zhang et al. 2021). Six-armed robots are useful for creating welds because they can perform multiple operations simultaneously during the manufacturing and welding process. The actions performed by the robot are pre-programmed, minimizing the chance of errors during the manufacturing process.

15) This technology is used for explosive welding, which uses an explosion to weld materials together during the manufacturing process. Explosion welding is used in many industries where the welding process must be performed very quickly and accurately. The explosive is placed on a baffle plate attached to the detonator. The distance between the flyer plate and the base plate is separated by the standoff distance. The igniter is first activated using a robotic arm, which creates an explosion in a buffer plate designed to prevent damage to the fryer plate (Yan et al 2019). A high pressure is created on the flyer plate, causing the top plate to fly and attach to the base plate. This is caused by the creation of high pressure on the base plate, which then melts and fuses the material on the base plate. This solidification process welds the flyer sheet to the base plate and forms a heavy weld pool on the base plate. Robotic technology in this welding process helps control all welding stages, from igniting the ignition to completing the welding process.



Explosive welding

ADVANTAGES OF THE ROBOTIC WELDING PROCESS

The advantages of the robotic welding process are:-

1) The high consistency of the welding process helps the industry to repeat the same welding process regularly to improve productivity. This consistency results in a greater amount of weld pooling, which also results in stronger weld joints. The welding quality is higher and better as it is done by a pre-programmed robot that performs the welding without the possibility of error during operation. This welding technique is used in the industry to increase productivity and deliver products on time.
2) Uses robotic technology to increase the efficiency of the welding process and reduce waste. If the welding process is performed robotically, the chances of error are minimized. The robot is fully pre-programmed for all welding phases and activities involved during the welding process (Epping et al. 2018). Pre-programmed activities help control all activities in advance, improving the finalization process during the crafting process. Effectiveness and pre-determination of welding work reduces waste when carrying out the welding process.
3) Reduced waste generation during welding reduces post-weld clean-up associated with scrap and waste generated during the welding process. The high efficiency of this welding technology means that no scrap is generated during the welding process and less energy is required to clean up the waste generated during the welding process.

DISADVANTAGES OF THE ROBOTIC WELDING PROCESS

Disadvantages of the robotic welding technique are:

1) Company's cost analysis is performed in every industry to remain competitive while increasing revenue. Weldable robots are so expensive that they are still not used by most companies to reduce product costs.
2) Robotic welding technology is not yet used in most industries due to its lack of flexibility. This flexibility comes with adapting to new techniques, as robots are pre-programmed, making it difficult to adapt to new welding techniques (Romeo et al 2020). Next, the robot must be pre-programmed with the process of using this technology to control all activities. This takes a lot of time during the welding process. This makes the welding process inflexible and creates time lags between welding processes.
3) There are risks when using robots in welding technology. This risk includes the condition that if the robot fails due to mechanical failure, the industry will have trouble doing further welding work. Therefore, the industry should not rely entirely on robots for welding tasks.

CONCLUSION

Robotic welding techniques are being analysed to perform welding processes in industry. This welding technology can be used in many large and small industries, with the main application being analysed in the automotive industry. The various types of welding techniques practiced in the industry include electron beam welding, ultrasonic welding, high frequency induction welding, explosive welding, arc welding and friction welding. Industry makes the most of 6-arm robots to control all welding processes. This welding technology helps meet market demands for products very easily during the welding process. Products are in high demand when market demand is always at its highest, and this process helps in rapid production and launch.

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