

# PRINCIPLES OF ADVANCED MANUFACTURING

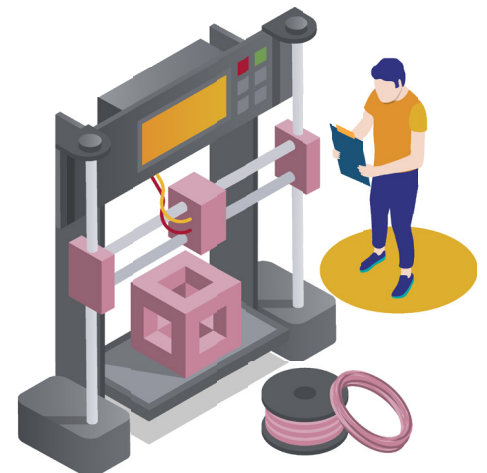


**CONCEPT** The Principles of Advanced Manufacturing refer to the use of computer-controlled systems and automation technologies to streamline and optimize the manufacturing process. Through design, planning, production, quality control and logistics. Computer Integrated Manufacturing (CIM) integrates various technologies such as computer-aided design (CAD), computer-aided manufacturing (CAM), robotics and sensors to improve production efficiency, reduce production costs and enhance product quality.

This enables manufacturers to quickly adapt to market changes, reduce lead times and customize products to meet specific customer needs. They also facilitate data analysis, process monitoring and predictive maintenance, allowing manufacturers to identify and address potential issues before they become significant problems. Overall, the principles of advanced manufacturing represent a paradigm shift in the way products are designed, produced and delivered, driving innovation and competitiveness in the global market.

## BACKGROUND

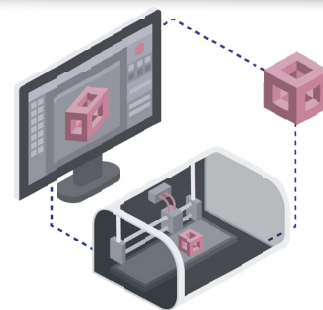
CIM is a concept that emerged in the 1970s to describe the integration of computer systems with manufacturing processes. It aimed to improve the efficiency and quality of manufacturing by automating and integrating all aspects of the production process, from design to delivery. CIM enabled manufacturers to automate many of the manual tasks previously performed by human workers, leading to increased efficiency, lower costs and higher product quality. Over time, CIM evolved to include more advanced technologies such as robotics, artificial intelligence, and the Internet of Things, which have further revolutionized manufacturing processes. Today, Principles of Advanced Manufacturing continue to evolve as new technologies emerge and are integrated into the manufacturing process.



## DATA

Various mathematical models and algorithms may be used in the design, simulation, optimization and control of advanced manufacturing processes and systems. Examples of these models and algorithms include finite element analysis, computational fluid dynamics, kinematic modeling, numerical optimization, control theory, and artificial intelligence. The specific variables and constants used in these models and algorithms depend on the particular application and can vary widely.

*Make sure it measures up*

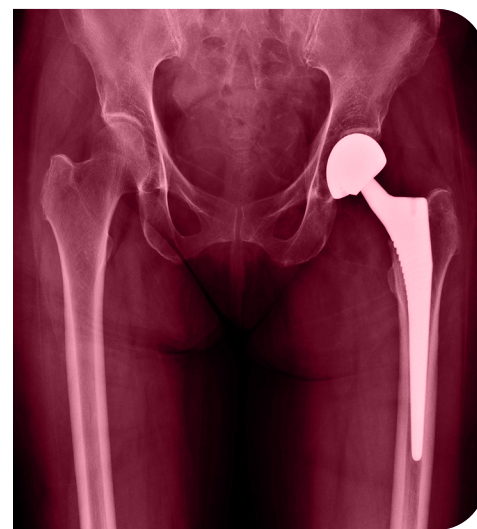


## REAL WORLD CONNECTIONS

One example of Principles of Advanced Manufacturing in Nebraska is the manufacturing process of Caterpillar Inc., a global manufacturing company that produces heavy equipment and machinery. Caterpillar utilizes computer-integrated manufacturing principles to optimize their production process, including computer-aided design (CAD) and computer-aided manufacturing (CAM) software to streamline design and production processes. They also use robotics and automation in their factories to improve efficiency and reduce errors.

## EXAMPLE

Take for example, the production of customized orthopedic implants. This process involves using advanced software to create 3D models of the patient's bone structure from medical imaging data. The software then generates a design for a custom implant that will fit the patient's anatomy perfectly. The design is sent to a computer-controlled manufacturing system, which uses precision cutting tools to create the implant from a block of high-strength metal. The implant is then finished and coated with a special material to promote healing and prevent infection. This technology has revolutionized the field of orthopedic surgery, allowing for faster and more accurate production of custom implants that can greatly improve the quality of life for patients.



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