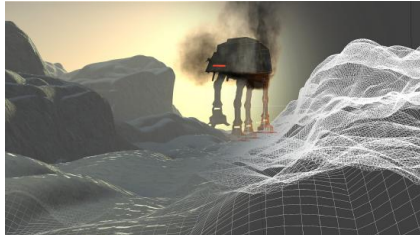


27.14: New Technologies

Learning Objectives

- Describe CAD
- Describe CAM
- Describe 3D printing
- Describe flexible manufacturing



With certain kinds of manufacturing processes—especially ones demanding high precision and mass production—it can be difficult or too costly to find the skilled labor needed to perform the tasks. This pressure has led to a growing reliance on computers and highly specialized software systems. Some of these new, sophisticated technologies are described below.

Computer-Aided Design

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising, and technical manuals. The ubiquity and power of computers today means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by the engineers of the last century.

Computer-Aided Manufacturing

Computer-aided manufacturing (CAM) is the use of software to control machine tools in the manufacturing of workpieces. Its primary purpose is to speed the production process and produce components and tooling with more precise dimensions and material consistency. In some cases this enables production using only the required amount of raw materials—thus minimizing waste and reducing energy consumption.

In the following video, a CNC carving machine uses a computer program (CAD/CAM) to create an amazing woodcarving. (Note that the video has no narration. Access audio description by using the widget below the video.)



Access the [text alternative for “Paradise Box Vcarve on CNC”](#) (opens in new window).

Computer-Integrated Manufacturing

Computer-integrated manufacturing (CIM) is a manufacturing approach that uses computers to control the entire production process. This integration allows individual processes to exchange information with one another and initiate actions. Although CIM can be faster and less error prone than conventional manufacturing, the main advantage is the ability to create automated manufacturing processes.

Watch this short video of a factory in which CIM is used in the factory production line to build the Kia Sportage. (Note that the video has no narration. Access audio description by using the widget below the video.)



Access the [text alternative for “Car Factory – Kia Sportage Factory Production Line”](#) (link opens in new window).

Flexible Manufacturing Systems

A **flexible manufacturing system (FMS)** offers flexibility in the way the production system reacts to changes, whether planned or unplanned. This flexibility is typically built into one of the following:

- **Machine flexibility:** the system can be changed to produce new product types or alter the order of operations executed on a part.
- **Routing flexibility:** the system has multiple machines that can perform the same operation on a part, or the system can absorb large-scale changes in volume, capacity, or capability.

An FMS has immense advantages over traditional production lines in which machines are set up to produce only one type of good. When the firm needs to switch a production line to manufacture a new product, substantial time and money are often spent modifying the equipment. An FMS makes it possible to change equipment set-ups merely by reprogramming computer-controlled machines. Such flexibility is particularly valuable to companies that produce customized products.

3D Printing

3D printing (or additive manufacturing, AM) is any of various processes used to make a three-dimensional object. In 3D printing, additive processes are used, in which successive layers of material are laid down under computer control. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. A 3D printer is a type of industrial robot. Several different 3D printing processes have been invented since the late 1970s. The printers were originally large, expensive, and highly limited in what they could produce; today they are much cheaper and more versatile.

The following short videos show 3D printing in action:



You can view the [transcript for “Makerbot”](#) (opens in new window) or the [text alternative for “Makerbot”](#) (opens in new window).



You can view the [transcript for “Student Builds Prosthetic With 3D Printer”](#) (opens in new window) or the [text alternative for “Student Builds Prosthetic With 3D Printer”](#) (opens in new window).

The main differences between 3D printing processes are in the way layers get deposited to create parts and in the materials used to produce those layers. Some methods melt or soften material to produce the layers, while others cure liquid materials using different sophisticated technologies. The primary considerations in choosing a 3D printer are speed, cost of the machine, cost of the printed prototype, cost and choice of materials, and color capabilities.

Regardless of the type of technology being used in the production process, consumers benefit greatly from these advances. Mass customization of everything from Yankee candles to T-shirts to beverage Koozies is possible because of these exciting advances in computer technology.

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