

Definition of a 'Robot'

- Robot Institute of America (1979)
A reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks.

Definition of a 'Robot'

- Webster
An automatic device that performs functions normally ascribed to humans or a machine in the form of a human.

First Use of the Word 'Robot'

- Acclaimed Czech playwright Karel Capek (1890-1938) made the first use of the word 'robot.'
- Czech word for forced labor or serf.



First Use of the Word 'Robot'

- The word Robot was introduced into his play R.U.R. (Rossum's Universal Robots) which opened in Prague in January 1921.
- Capek poses a paradise, where the machines initially bring so many benefits.
- But in the end bring an equal amount of blight in the form of unemployment and social unrest.

R.U.R's Theme

- Dehumanization of man in a technological civilization.
- Robots were not mechanical in nature but were created through chemical means.
- "It is with horror, frankly, that he rejects all responsibility for the idea that metal contraptions could ever replace human beings."

First Use of the Word 'Robotics'

- First used in Runaround, a short story published in 1942 by Isaac Asimov.
- "I, Robot," a collection of several of these stories, was published in 1950.



Asimov's first robot

- Asimov's fictional character - robotherapist.
- Modern counterpart - Eliza.
- Computer program for the study of natural language communication between man and machine.
- Programmed to simulate a psychotherapist by answering questions with questions.

Three Laws of Robotics

- Law Zero: A robot may not injure humanity, or, through inaction, allow humanity to come to harm.
- Law One: A robot may not injure a human being, or, through inaction, allow a human being to come to harm, unless this would violate a higher order law.

Three Laws of Robotics

- Law Two: A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law.
- Law Three: A robot must protect its own existence as long as such protection does not conflict with a higher order law.

The First Robot 'Unimate'

- After the technology explosion during World War II, in 1956, a historic meeting occurs between George C. Devol and Joseph F. Engelberger.
- Discuss the writings of Isaac Asimov.
- Commercially successful effort to develop a real, working robot.

The First Robot 'Unimate'

- Engelberger started a manufacturing company 'Unimation,' universal automation.
- first robot nicknamed the 'Unimate.'
- Engelberger has been called the 'father of robotics.'



The First Robot 'Unimate'

- The first Unimate was installed at a General Motors plant to work with heated die-casting machines.
- Perform spot welding on auto bodies.
- Both applications were commercially successful, i.e., the robots worked reliably and saved money by replacing people.

Unimation and Unimate

- Other tasks performed by robots - loading and unloading machine tools.
- Westinghouse acquired Unimation.
- Unimation is still in production today, with robots for sale.
- The robot idea was hyped to the skies and became high fashion in the Boardroom.

Making Robots 'Think'

- The idea of the "electronic brain" as the principal part of the robot was pervasive.
- Computer scientists were put in charge of robot departments of robot customers and of factories of robot makers.
- Many of these people knew little about machinery or manufacturing but assumed that they did.

Delusions

- Little training in the industrial engineer's material handling, manufacturing and economics in the factory.
- Robots ended up for experiments only. No real use in the factory.



Modern Industrial Robots



- Increased in capability and performance through controller and language development.
- Improved mechanisms, sensing, and drive systems.

Crash of the Robot Market

- In the early to mid 80's the robot industry grew very fast primarily due to large investments by the automotive industry.
- The quick leap into the factory of the future turned into a plunge.
- Integration and economic viability of these efforts proved disastrous.

Shakeout of the Robot Industry

- The robot industry has only recently recovered to mid-80's revenue levels.
- Only one US company, Adept, remains in the production industrial robot arm business.
- Most of the rest went under, consolidated, or were sold to European and Japanese companies.

Future of the Robot Industry

- Fully functioning androids (robots that look like human beings) are many years away.
- Real, working, sophisticated robots are in use today and they are revolutionizing the workplace.
- Industrial manipulators are really computer controlled "arms and hands."

Benefits of Robots

- Robots offer specific benefits to workers, industries and countries.
- If introduced correctly, industrial robots can improve the quality of life by freeing workers from dirty, boring, dangerous and heavy labor.

Benefits of Robots

- Can cause unemployment by replacing human workers.
- Create jobs: robot technicians, salesmen, engineers, programmers and supervisors.
- Improved management control, productivity and consistently high quality products.
- Robots can work tirelessly night and day.

Benefits of Robots

- Greatly reduce the costs of manufactured goods.
- As a result of these industrial benefits, countries that effectively use robots in their industries will have an economic advantage on world market.

Types of Robots

- Industrial Robots
- Mobile Robots
- Educational Robots
- Robots in Agriculture
- Robots in Space
- Robots Assisting the Handicapped
- Anthrobots

Welding Applications

- The most popular applications of robots is in industrial welding.
- The repeatability, uniformity quality, and speed of robotic welding is unmatched.



Welding Applications



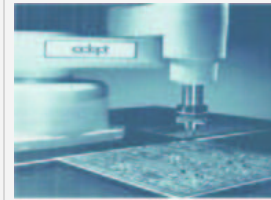
- Two basic types of welding are spot welding and arc welding.
- The automotive industry is a major user of robotic spot welders.

Spray Painting Applications

- The consistency and repeatability of a robot's motion have enabled near perfect quality while at the same time wasting no paint.



Assembly Operations



- Robots lend themselves well to the tedious and repetitive nature of assembly tasks.
- Repeatability allowed development of some new technologies in electronic assembly.

Palletizing

- Palletizing is the act of loading or unloading material onto pallets.
- Cincinnati Milacron Robot being used to palletize advertising inserts for a newspaper.



Material Handling

- In semiconductor industry's IC chip manufacturing facilities, various processes take place within a clean room.
- Robots are especially suited to the clean room environment.

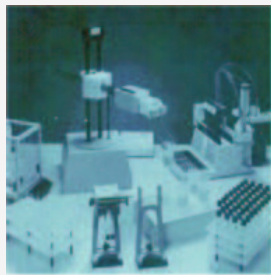


Dispensing Operations

- Dispensing sealants and glues is another task that has been given over to robots.
- Areas of interest - Window manufacturing, pc board masking, and automobiles.



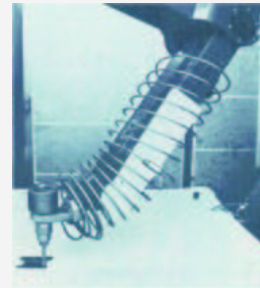
Laboratory Applications



- Laboratory tests have always been a labor intensive and therefore expensive operation.
- Time consuming and have the possibility for human error.
- Robots - "surrogate hands."

Waterjet Cutting

- Cutting operation using high pressure water.
- Used in plastics, rubber, cardboard type materials, plywood, polyvinyl chloride (PVC), glass, aluminum, stainless.



Work Cell



- A robotic work cell encompasses the area where a robot is programmed to work.
- Careful planning must be done in work cell design.

Mobile Robots

- Robotics technology found its first application in the nuclear industry with the development of teleoperators to handle radioactive material.
- Some of them are "walking" machines.



Educational Robots



- Schools use industrial robots to teach robotic programming, control, and work cell design.
- Some resemble industrial robots and some resemble AGV (Automated Guided Vehicles).

Robots in Agriculture

- Serious research is being conducted into the application of robots to agriculture.
- One of the more successful is the development of a sheep-shearing robot in Australia.



Robots in Space

- Space is hostile to humans, who require expensive protective clothing and Earth-like environments.
- Many suggest that robots, not people, should be sent into space.
- As autonomous robots are still in their technical infancy, they cannot yet be used to replace people.

Robots in Space

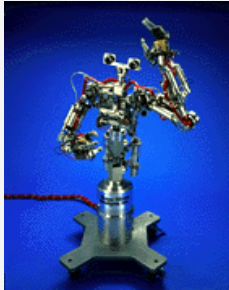
- Teleoperators, which combine human intelligence with mechanical manipulation, require a person in the loop.
- This has been achieved with the space shuttle arm.

Robots Assisting the Handicapped

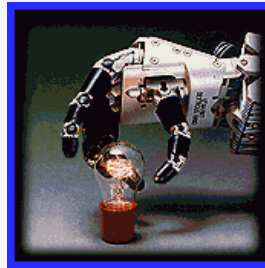
- Potential robotics aids for the disabled.
- Automatic wheelchairs which carry the occupant around a hospital in response to voice commands.
- Robots which feed severely handicapped people.
- Developers of these systems face severe economic restraints.

Anthrobots

- Most robots aren't built with the intention of simulating humans.
- Developing humanoids and simulating humans in a virtual environment.
- Building an artificial person.



Anthrobots



- An android must be able to see and interpret what it sees.
- It should have a more or less human shape and be able to move around.

Anthrobots

- It must be able to solve simple problems
- Cope with the unexpected.
- Have sensory input devices.
- Communicate in a human language.

