What is a Robot?

A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.

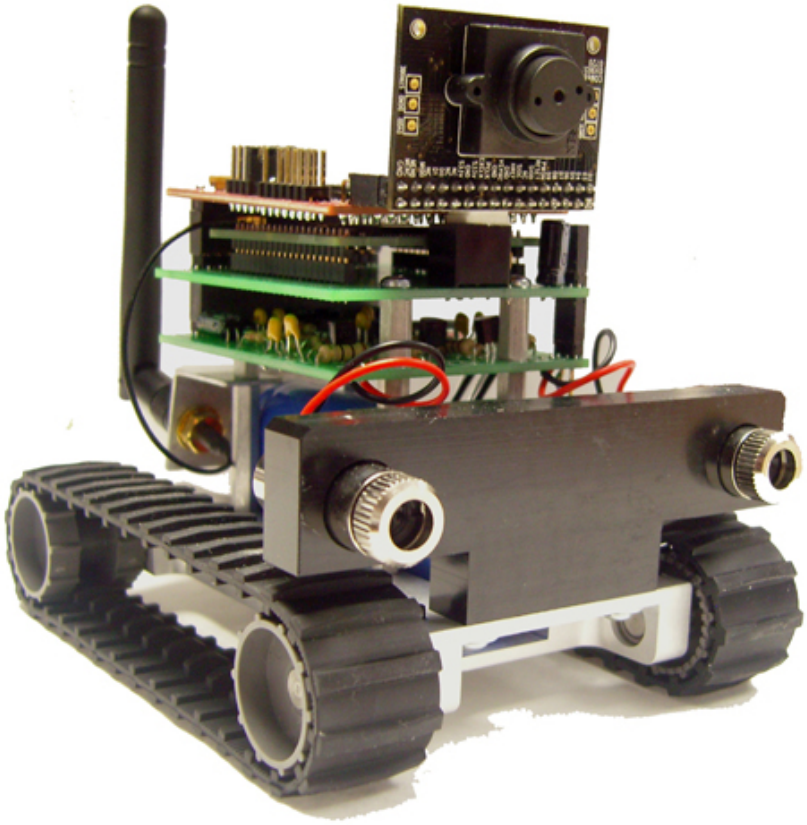
(Robot Institute of America)

Features

- Reprogrammable manipulator
- Multifunctional
- Motion

Robot Classification by Geometry

Mobile (wheel) robot



Parallel robot

ABB Tricept parallel robot

Serial robot

Adept Industrial robot

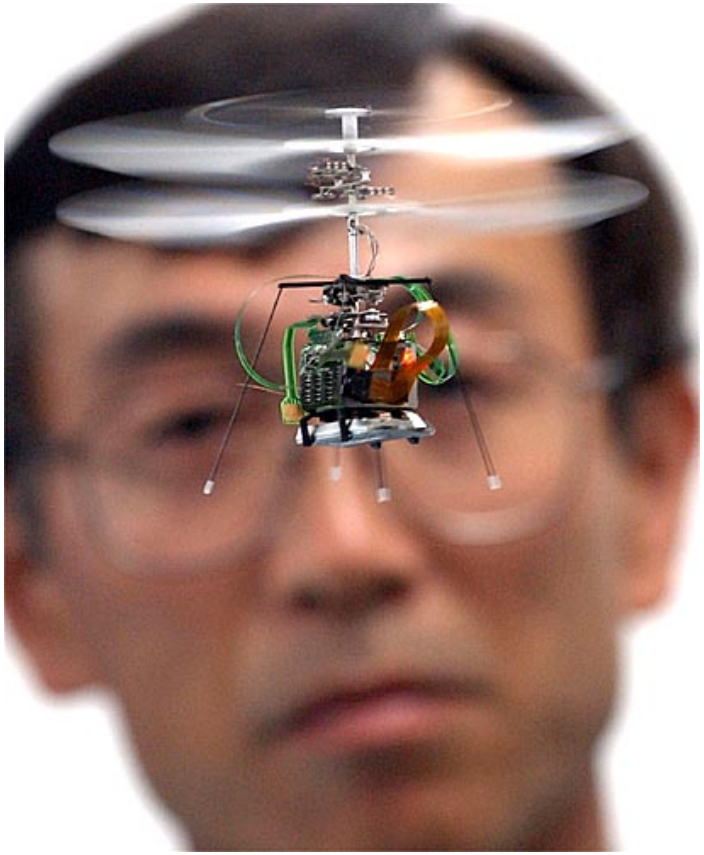
Mobile + Serial robot

NASA’s Mars rover

Humanoid robot

Honda Asimo

Flying robot



Seiko-Epson flying micro robot

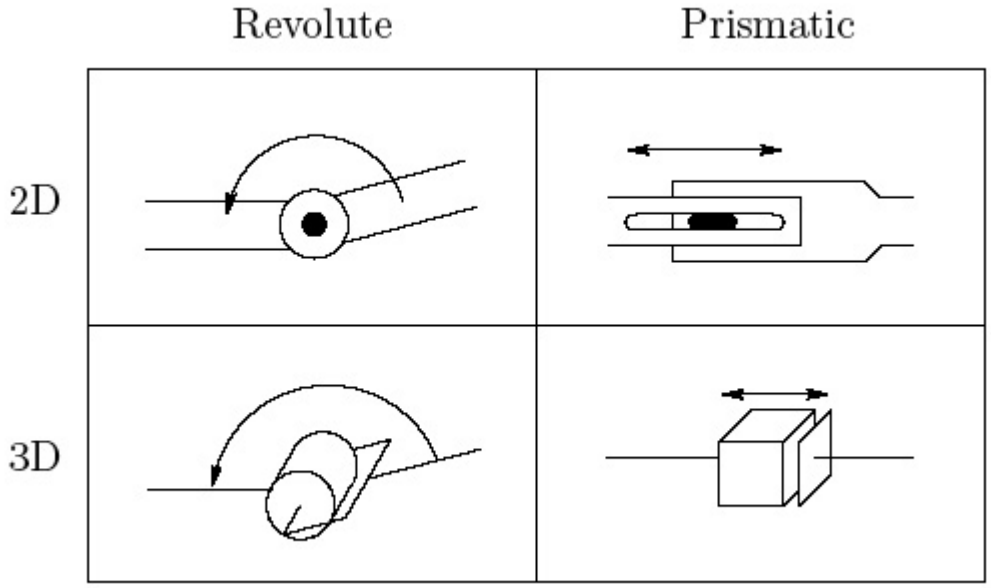
Serpentine robot

Serial Manipulator

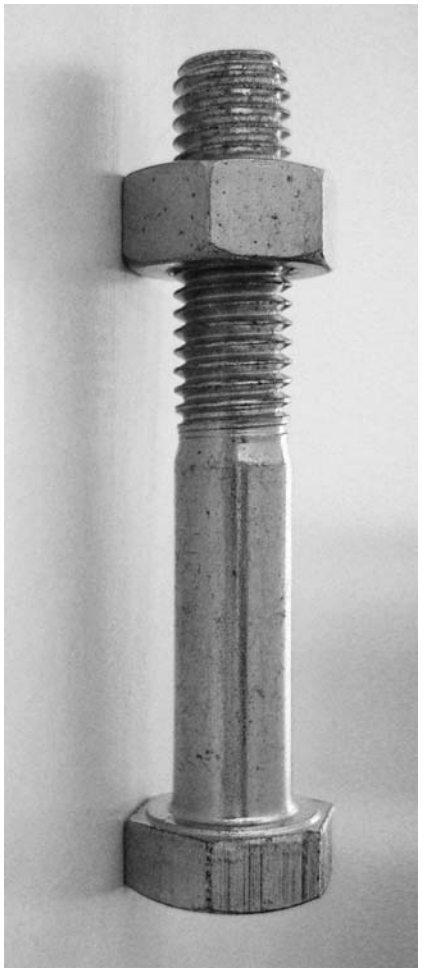
- large workspace
- simple structure
- achieve various tasks through changeable wrists and end effectors
- most common → industrial robots

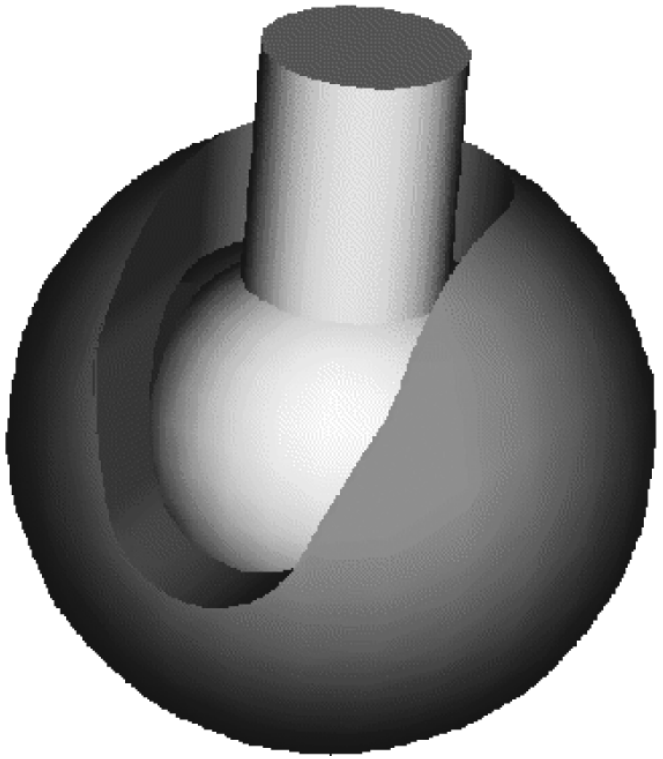
Types of Joint

- prismatic joint
- revolute joint

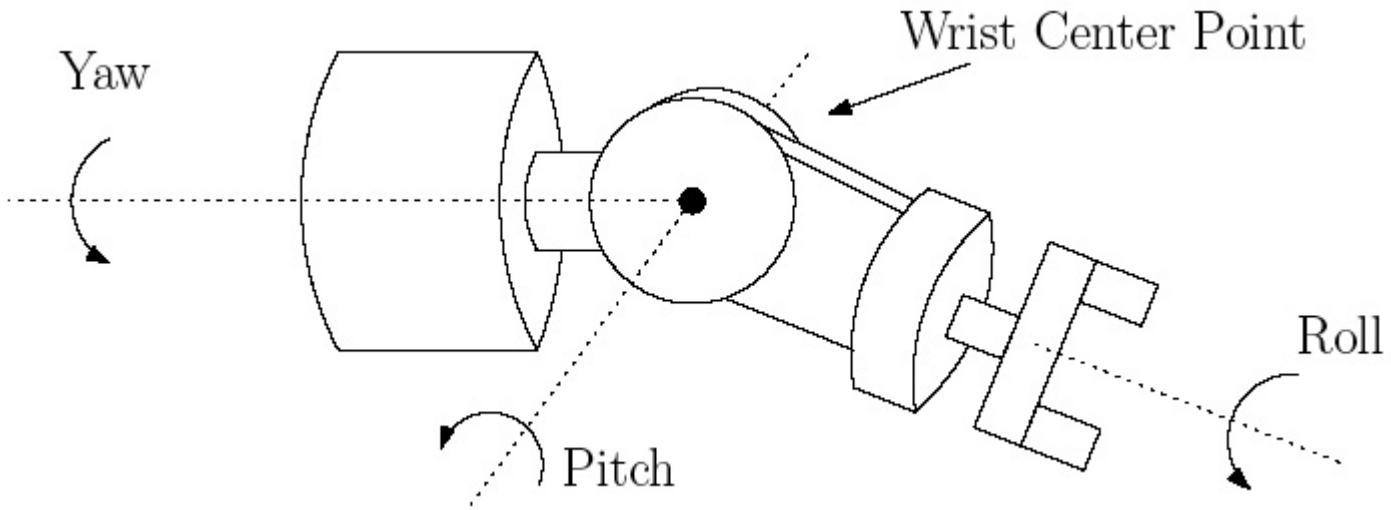


- helical joint (prismatic + revolute)
- spherical joint





Wrists



Spherical wrist

End effectors

Common Kinematic Arrangements

Articulated Manipulator (RRR)

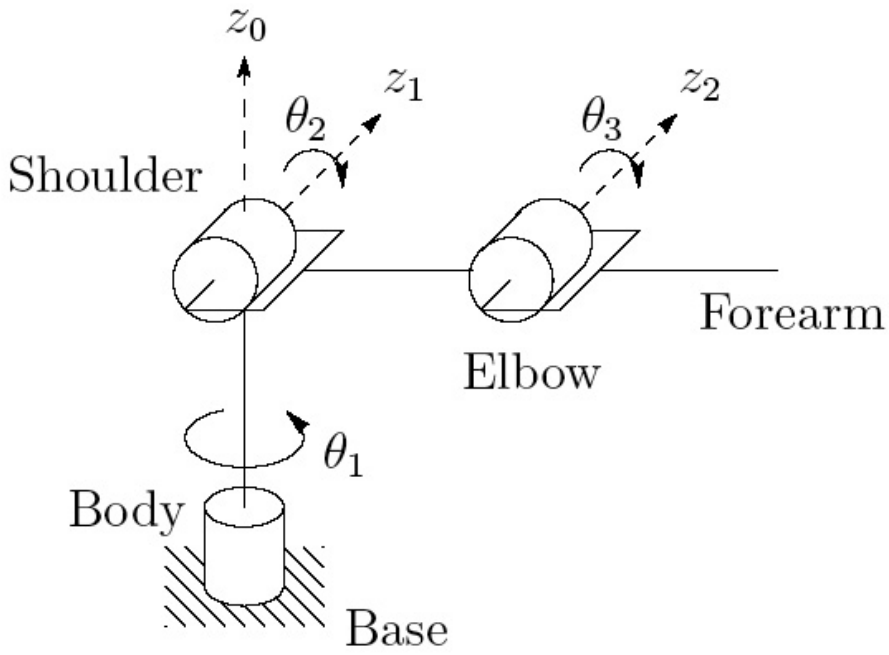
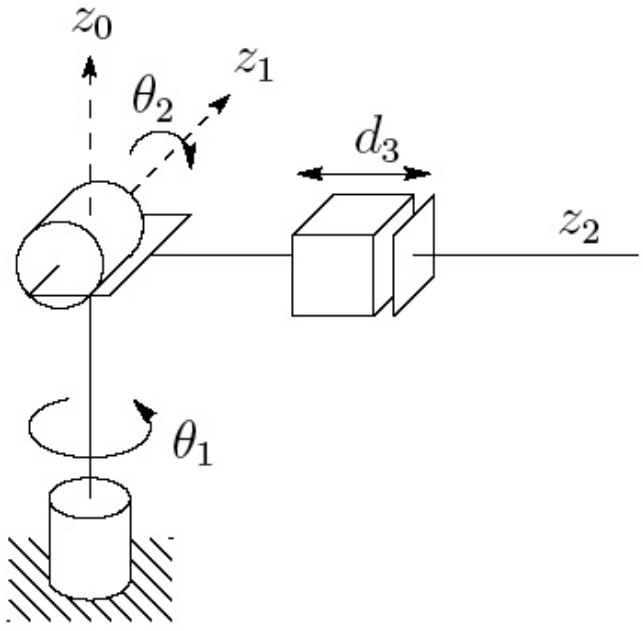


Figure 1.9: The ABB IRB1400 Robot, a six-DOF elbow manipulator (right). The symbolic representation of this manipulator (left) shows why it is referred to as an anthropomorphic robot. The links and joints are analogous to human joints and limbs. (Photo courtesy of ABB.)

Spherical Manipulator (RRP)



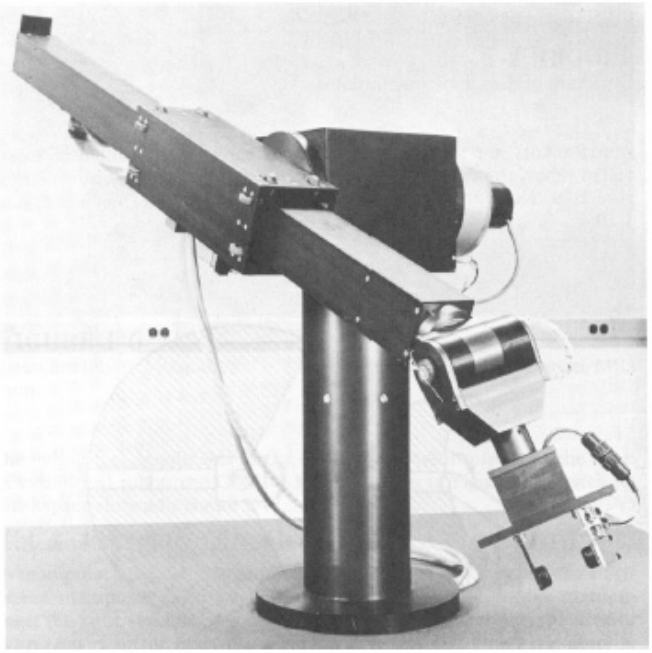


Figure 1.12: The Stanford Arm is an example of a spherical manipulator. The earliest manipulator designs were spherical robots. (Photo courtesy of the Coordinated Science Lab, University of Illinois at Urbana-Champaign.)

SCARA Manipulator (RRP)

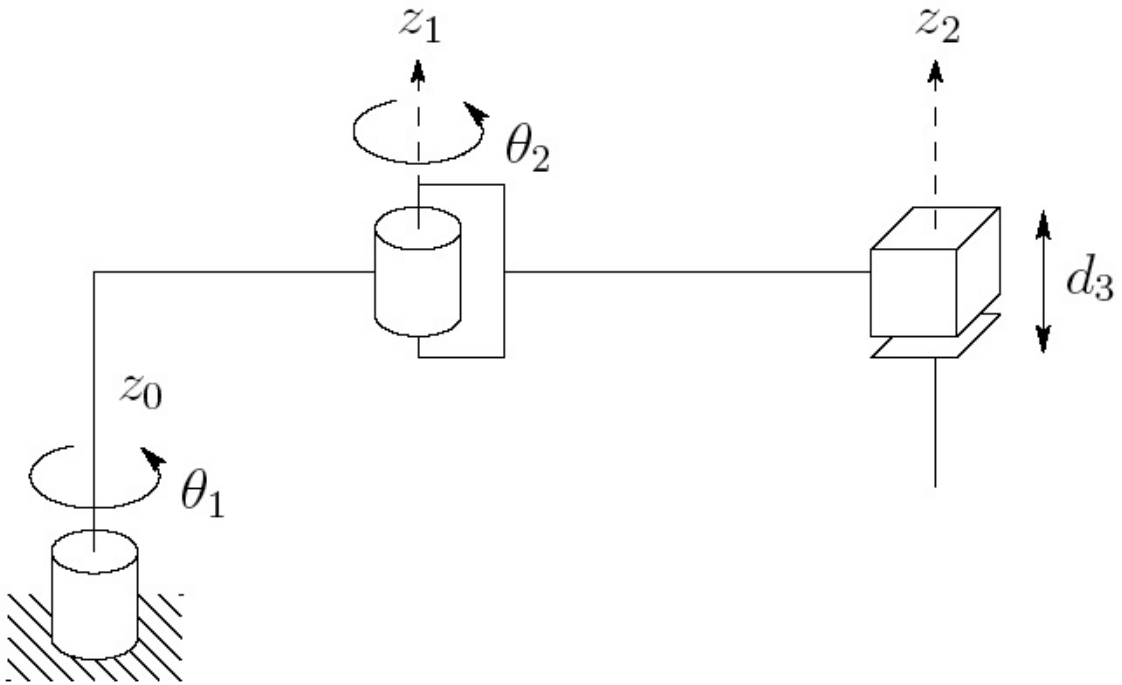


Figure 1.13: Symbolic representation of the SCARA arm.

SCARA Manipulator (RRP)

Figure 1.14: The Adept Cobra Smart600 SCARA Robot. The SCARA design is ideal for table top assembly, pick-and-place tasks, and certain types of packaging applications. (Photo Courtesy of Adept Technology, Inc.)

Cylindrical Manipulator (RPP)

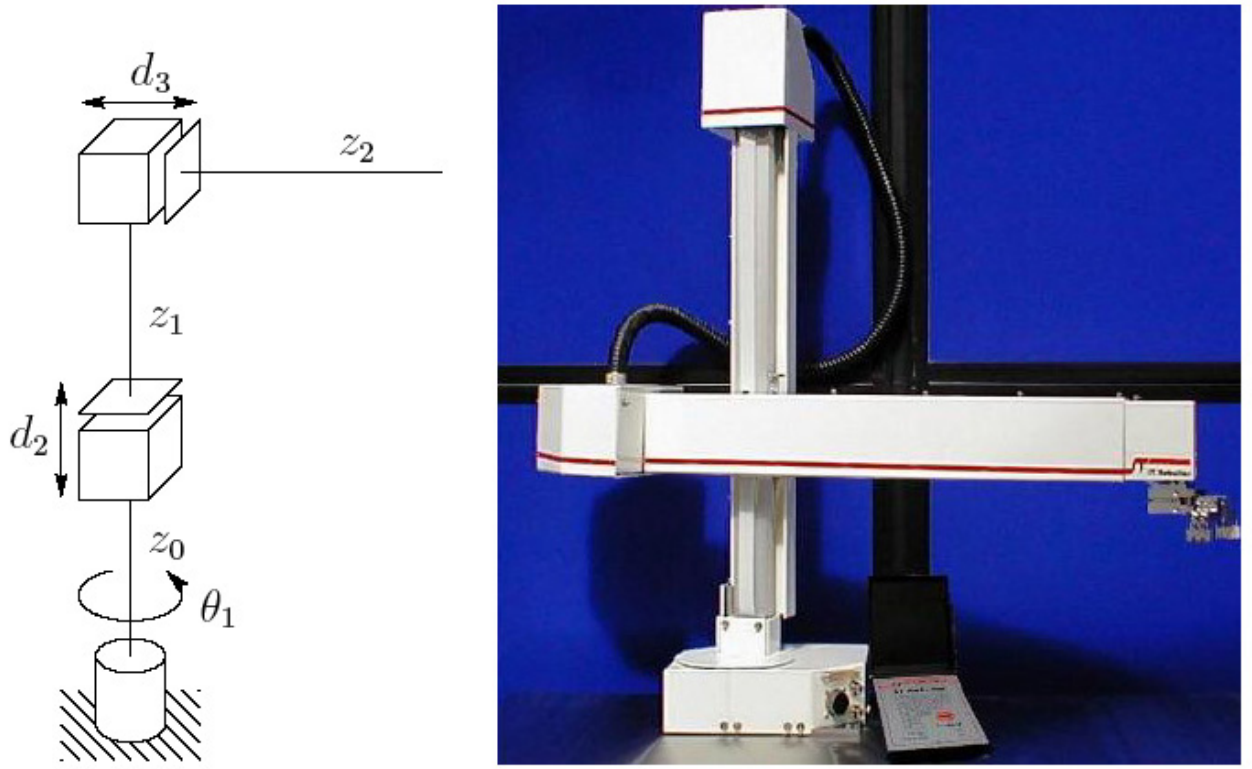


Figure 1.15: The Seiko RT3300 Robot cylindrical robot. Cylindrical robots are often used in materials transfer tasks. (Photo courtesy of Epson Robots.)

Cartesian Manipulator (PPP)

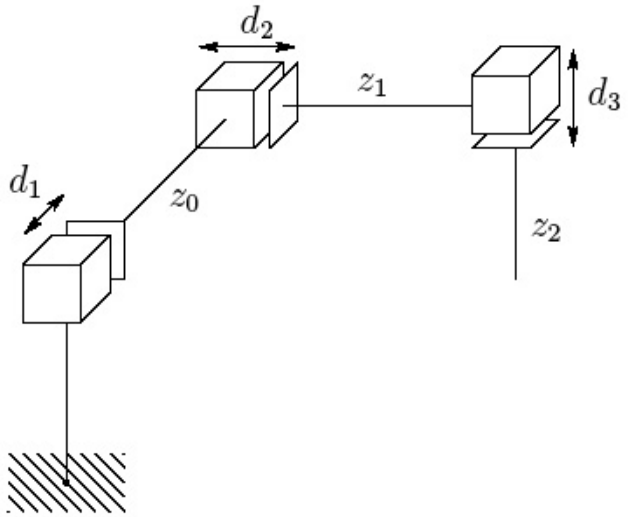


Figure 1.16: The Epson Cartesian Robot. Cartesian robot designs allow increased structural rigidity and hence higher precision. Cartesian robots are often used in pick and place operations. (Photo courtesy of Epson Robots.)

Parallel Manipulator

Figure 1.18: The ABB IRB940 Tricept parallel robot. Parallel robots generally have much higher structural rigidity than serial link robots. (Photo courtesy of ABB.)

Workspace: space which the end-effector can reach

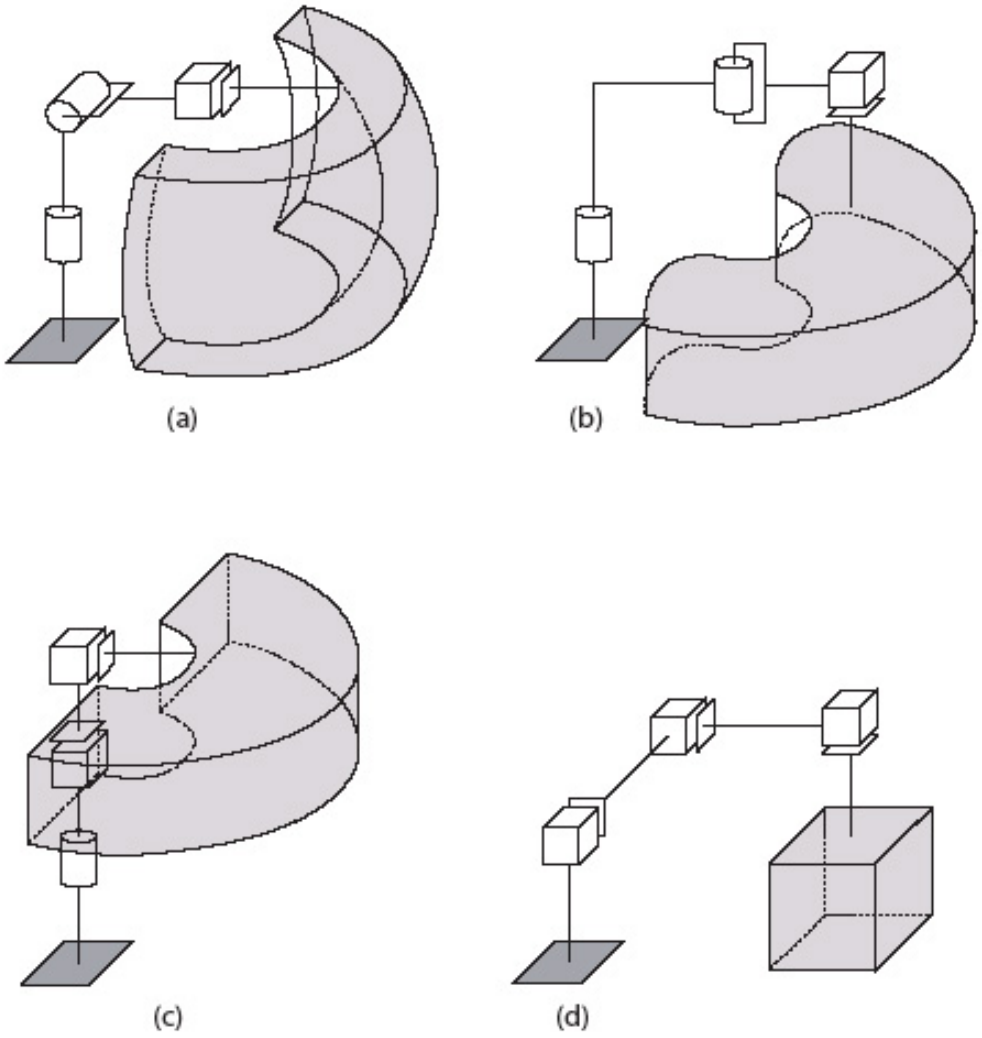


Figure 1.17: Comparison of the workspaces of the (a) spherical, (b) SCARA, (c) cylindrical, and (d) Cartesian robots. The nature of the workspace dictates the types of application for which each design can be used.