

Robotics I

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The articulated robotic structure in Fig. 1 is used for diagnostic and interventional imaging in cardiology and radiology. The robot has a branched kinematics, with a serial chain of bodies having five revolute joints, followed by two symmetric final ‘branches’. Each branch can be modeled as having two elementary joints (one prismatic and one revolute) that move in perfect coordination with those of the other branch. This kinematic structure provides a convenient positioning and orienting flexibility to the imaging device that operates along the segment between the tips of the two branches.



Figure 1: The Siemens Artis Zeego medical robot and its degrees of freedom

- Consider only one branch of the robot, i.e., a serial kinematic chain with 7 dofs:
 1. assign the robot frames according to the Denavit-Hartenberg convention, and draw the frames on the sheet;
 2. provide the associated table of D-H parameters, and enter also reasonable (approximate) values for the joint variables at the robot configuration shown in the figure.
- Consider now the complete robot and the midpoint P of the (variable length) segment joining the tips of the two robot branches. The motion of which joints does not affect the position of P ? Can we state that this robot has a spherical wrist?

[120 minutes; open books]