

CS422 Robotics and Automation

Assignment 2

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Due 8th Nov. Late submissions will not be accepted

Read Textbook Chapter 3 and answer the following questions¹:

The two problems are based on the textbook, Robot Modeling and Control by Spong, Hutchinson, and Vidyasagar (SHV). Please follow the extra clarifications and instructions when provided.

1. **SHV 3-7 – Three-link Cartesian Robot (20pts):**

Your solution should include a schematic of the manipulator with appropriately placed coordinate frames, a table of the DH parameters, and the final transformation matrix. Then answer the following question: What are the x, y, and z coordinates of the tip of the robot's end-effector in the base frame (as a function of the robot parameters and the joint coordinates)?

2. **SHV 3-6 – Three-link Articulated Robot (20 points)**

Your solution should include a schematic of the manipulator with appropriately placed coordinate frames, a table of the DH parameters, and the final transformation matrix. Then answer the following question: What are the x, y, and z components in the base frame of a unit vector pointing along the robot's last link (from the third joint to the tip, as a function of the robot parameters and the joint coordinates)?

You can use either the standard DH convention following our textbook or the modified DH convention following "Introduction to Robotics: Mechanics and Control (3rd Edition)".

¹Some of the assignment materials were adapted from the open materials used in MEAM520 at the University of Pennsylvania, created by Dr Katherine J. Kuchenbecker