

1. Consider a robot with 7 joints and a space Jacobian with a maximum rank of 6 over all configurations of the robot. At the current configuration, the rank of the space Jacobian is 5. Which of the following statements is true? Select all that apply.

1 / 1 point

☒ The robot is redundant with respect to the task of generating arbitrary end-effector twists.

☒ Correct

The robot is capable of 6-dimensional twists at certain configurations, and it has more joints than needed to do so.

☐ The robot is kinematically deficient with respect to the task of generating arbitrary end-effector twists.

☒ The robot is at a singularity.

☒ Correct

The rank of the Jacobian is less than the maximum possible, so the robot is at a singularity.

2. Consider a robot with 7 joints and a space Jacobian with a maximum rank of 3 over all configurations of the robot. At the current configuration, the rank of the space Jacobian is 3. Which of the following statements is true? Select all that apply.

1 / 1 point

☐ The robot is redundant with respect to the task of generating arbitrary end-effector twists.

☐ The robot is at a singularity.

☒ The space Jacobian is "fat."

☒ Correct

The Jacobian has more columns than rows, so it is "fat," but it is not redundant with respect to generating arbitrary twists, because the rank of the Jacobian is nowhere equal to 6.

3. Consider a robot with 8 joints and a body Jacobian with rank 6 at a given configuration. For a given desired end-effector twist \mathbf{V}_e , what is the dimension of the subspace of joint velocities (in the 8-dimensional joint velocity space) that create the desired twist?

1 / 1 point

☒ 2

☐ 0

☐ The desired twist cannot be generated.

☒ Correct