Congratulations! You passed!

Grade received 85.71% **To pass** 80% or higher

Go to next item

1. True or false? The Jacobian matrix depends on the joint variables. 1 / 1 point

- (•) True.
- ( ) False.

Correct

2. True or false? The Jacobian matrix depends on the joint velocities. 1 / 1 point

- ( ) True.
- (•) False.

Correct

3. True or false? Row i of the Jacobian corresponds to the end-effector velocity when joint i moves at unit speed and all other joints are stationary. 1 / 1 point

- ( ) True.
- (•) False.

Correct
Column i corresponds to the end-effector velocity when joint i moves at unit speed and all other joints are stationary.

4. Consider a square Jacobian matrix that is usually full rank. At a configuration where one row of the Jacobian becomes a scalar multiple of another row, is the robot at a singularity? 1 / 1 point

- (•) Yes.
- ( ) No.

Correct
If two rows become aligned, or two columns become aligned, the rank of the Jacobian drops and the robot is at a singularity.

5. In general, a sphere (or hypersphere, meaning a sphere in more than 3 dimensions) of possible joint velocities maps through the Jacobian to 0 / 1 point

- ( ) a sphere (or hypersphere).
- (•) a polyehdron.
- ( ) an ellipsoid (or hyperellipsoid).

Incorrect

6. Assume a three-dimensional end-effector velocity. At a singularity, the volume of the ellipsoid of feasible end-effector velocities becomes 1 / 1 point

- (•) zero.
- ( ) infinite.

Correct
At least one of the principal semi-axes of the ellipsoid becomes zero.

7. At a singularity, 1 / 1 point

- ( ) some end-effector forces become impossible to resist by the joint forces and torques.
- (•) some end-effector forces can be resisted even with zero joint forces or torques.

Correct
A singularity means the end-effector cannot move in one or more directions. Therefore, the robot can resist arbitrary forces trying to move it in one of these directions (without applying forces and torques at the joints).