Congratulations! You passed!

Grade received 100% To pass 80% or higher

Go to next item

1. If the wrench $-\mathcal{F}$ is applied to the end-effector, to stay at equilibrium the robot must apply the joint forces and torques $\tau = J^{\mathrm{T}}(\theta)\mathcal{F}$ to resist it. If the robot has 4 one-dof joints, what is the dimension of the subspace of 6-dimensional end-effector wrenches that can be resisted by $\tau = 0$? 1 / 1 point

- 2-dimensional.
- (•) At least 2-dimensional.
- 4-dimensional.
- At least 4-dimensional.

Correct
The rank of a matrix and its transpose is the same. The maximum rank of the Jacobian (and therefore its transpose) is 4. If the rank is 4, then there is a $6 - 4 = 2$-dimensional subspace of wrenches that map to $\tau = 0$. (The "6" is from the dimension of the wrench space.) But if the robot is at a singularity, the rank could drop below 4, and then there would be an even higher-dimensional subspace of wrenches that map to $\tau = 0$.

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