MEE5114 Advanced Control for Robotics

Lecture 13: Differential Inverse Kinematics

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Inverse Kinematics Problem

- Forward kinematics: $\theta \rightarrow T(\theta) = (R(\theta), p(\theta))$
- Often times, we are interested in certain aspect of the pose:
- Inverse Kinematics:
- Analytical solution vs numerical solution:

Differential IK (1/1)

- Differential Kinematics:
  - Geometric Jacobian:
  - Analytical Jacobian:
- Differential IK:

Differential IK (2/2)

- Solution of Differential IK:

- **Singularity**:
  - Representation Singularity:

  - Kinematic Singularity:

Optimization-Based Differential IK

- Given task space velocity $\dot{x}_d$, find $\dot{\theta}$

Differential IK with Constraints

- Given task space velocity $\dot{x}_d$, find $\dot{\theta}$ with constraints $\theta_i \in [\theta_i^-, \theta_i^+]$, and $\dot{\theta}_i \in [\dot{\theta}_i^-, \dot{\theta}_i^+]$, $i = 1, \ldots, n$

More Discussions

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