EECS 367 Lab:
KinEval IK Control Flow and Parameters
Lab Takeaways

1) **KINEVAL Overview**

2) **KINEVAL Walkthrough**

How to start assignment 5
## Forward Kinematics Overview

<table>
<thead>
<tr>
<th>Assignment 5: Inverse Kinematics</th>
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<tbody>
<tr>
<td>6 All  Manipulator Jacobian</td>
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<tr>
<td>3 All  Gradient descent with Jacobian transpose</td>
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<tr>
<td>3 All  Jacobian pseudoinverse</td>
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<td>6 Grad Euler angle conversion</td>
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- **Features assigned to all sections**
- **Features assigned to graduate sections**
KinEval Overview

All code for assignment 5
Implement `iterateIK()` such that each joint along the endeffector path results with an update to its .control term.
KinEval IK Parameters

• iterate_inverse_kinematics(...)
  • eneefector_target_world
    • Target pose of end effector for IK, .position and .orientation
  • eneefector_joint
    • String name of joint connected to end effector
  • eneefector_position_local
    • Position of end effector with respect to local frame

• kineval.params.ik_steplength
  • Size of step to take along configuration gradient when updating control

• kineval.params.ik_pseudoinverse
  • Boolean flag denoting which method to use (Jacobian transpose or pseudo inverse)
Performance Validation

- `kineval.randomizeIKtrial()`
  - Source code will be provided in assignment slack channel
  - Grad-extension points for reaching at least 100 targets in 60 seconds

- Inverse Kinematics will react in realtime
  - IK will account for manual adjustments to robot base or joint angles
  - Also for any modification to end effector target

**Base Controls**

- Q
- W
- E
- A
- S
- D

**End Effector Target Controls**

- R
- F

**IK Toggle**

- P
State

$\Delta x_n = x_d - x_n$

$x_n \rightarrow x_d$

$\Delta q_n = J(q_n)^{-1} \Delta x_n$

$q_{n+1} = q_n + \gamma \Delta q_n$

$O_{world}$

$x_d \sim \text{endeffector\_target\_world}$

$q_n \sim \text{robot\_joints}$

$p^{x_n} \sim \text{endeffector\_position\_local}$

$x_n = T^O_{x_n} p^{x_n}$

$\gamma \sim \text{kineval\_params\_ik\_steplength}$

KinEval Variables