Final Project
Intro to Robotics

ME4140 - Dr. Stephen Canfied

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Summary

- Introduction
- Robotic Arm
- Inverse Kinematics
- Path
  - Sphere
  - Phrase
- Pseudocode
- Demonstration

Introduction

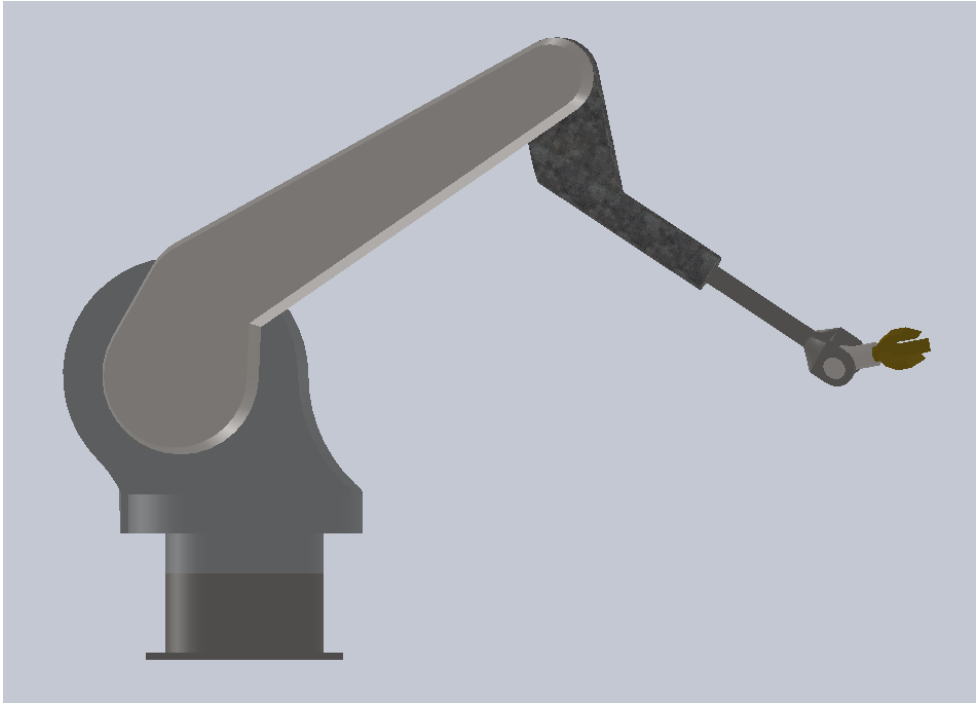
- Six degrees-of-freedom robotic arm
- Six revolute joints
- The last three joints form a wrist configuration

Robotic Arm

- It was designed using *3D CAD Design Software SolidWorks*

- Once designed, all the parts were assembled to inspect some arm's motion aspects such as the limit angles of the joints.

Robotic Arm



Inverse Kinematics

- Analytically solved for all joints variables
- It was needed minor changes on the original design
  - Simplified solution
- When there were two possible solutions for a variable
  - The closest one to the prior value was chosen

Path

- Two paths were developed
  - Sphere
    - The end-effector aims to the center the whole time
      - Welding idea
  - Phrase
    - *“That’s all folks!”*
    - Ellipse path around the phrase

Sphere

- The Jacobian Matrix, which is used to transfer cartesian to spherical coordinates, was used to calculate the end-effector orientation

- As the end-effector moves vertically along the sphere, the number of points in that circumference changes due to resolution issues
  - circumferences located near poles, the number is smaller.
  - however, for those near the midst part, the number is greater and constant.

Phrase

- End-effector aims to the letters
  - Writing appearance
- Some points were added on Z-direction
  - End-effector steps back after each movement
- Ellipse circulates around the phrase
  - A funny soundtrack was added

Pseudocode

- STL file readings
- Objects are moved to their origin and orientation
- H&D table
- Set arm's initial position and orientation using forward kinematics
- Sphere path
  - *for* loop
    - Inverse kinematics
    - Forward kinematics
    - Animation/plot
- Phrase path

Demonstration

Questions?!
Thank you!

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