GUI-Based Serial Link Kinematics Solver

Objective:

The objective of this assignment is to develop a graphical user interface (GUI) application in MATLAB for solving serial link kinematics problems. Students will design a user-friendly interface that allows users to input serial link configurations and select the type of problem (forward or inverse kinematics). They will then implement algorithms to solve the selected problem type and display the final pose of the serial link robot.

Assignment Tasks:

1. **Installation and Setup:**

   - Ensure MATLAB is installed on your computer.
   - Familiarize yourself with MATLAB's GUI development tools, such as App Designer.
   - Install Peter Corke's robotics toolbox for MATLAB.

2. **GUI Design:**

   - Input fields for specifying the serial link parameters (e.g., link lengths, joint angles,….. etc).
   - Buttons or dropdown menus for selecting the problem type (forward or inverse kinematics, robot workspace drawing).
   - Buttons for submitting the input and solving the problem.
   - Output displays for showing the results.

3. **Forward Kinematics Solver:**

   - Implement algorithms to calculate the forward kinematics of the serial link robot based on the input parameters.

   - Verify the correctness of the forward kinematics calculations using appropriate mathematical formulations and algorithms.

4. **Inverse Kinematics Solver:**

   - Implement algorithms to calculate the inverse kinematics of the serial link robot based on the desired end-effector pose.

   - Ensure the inverse kinematics solver can handle multiple solutions if applicable and provide feedback to the user.

5. **Robot workspace drawing:**

    - Implement algorithms to calculate the workspace of the serial link robot based on the input parameters.

    - Draw and highlight all the possible points and paths the robot can take and reach out.

6. **Testing and Validation:**

    - Test the GUI application with various serial link configurations and problem types to ensure its functionality and accuracy.

    - Validate the results obtained from your solution versus Peter Corke's outputs.

7. **Documentation and Presentation:**

    - Document the design and implementation of the GUI application, including screenshots and descriptions of its features.

    - Prepare for demonstrating the functionality of the GUI and discussing the algorithms used for forward and inverse kinematics solving.

Assessment Criteria:

- Completeness and functionality of the GUI application
- Accuracy of the forward and inverse kinematics solvers
- User-friendliness and clarity of the GUI design
- Depth of understanding demonstrated in the documentation and presentation