World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:19, No:02, 2025

Quaternion Algebra Based Forward Kinematic Solution for 6-DOF Industrial Robots Instead of DH Parameters

Authors : Cengiz Deniz

Abstract : This paper presents a novel approach to solving the forward kinematics problem for six-degree-of-freedom (6-DOF) industrial robots using quaternion algebra. Traditional methods often rely on Denavit-Hartenberg (DH) parameters, which can be computationally expensive and complex for complex robot geometries. Quaternion-based methods offer a more streamlined and efficient alternative by providing a compact and intuitive representation of rotations. The proposed approach leverages quaternion algebra to calculate the target position of the robot's end-effector. By representing rotations as quaternions, the forward kinematics equations become more concise and computationally efficient. The paper demonstrates the effectiveness of the quaternion-based solution through simulations and real-world experiments, highlighting its improved accuracy and reduced computational overhead compared to DH parameter-based methods. This quaternion-based forward kinematic solution provides a valuable tool for optimizing robotic motion planning and enhancing operational safety in industrial applications.

Keywords : industrial robot, forward kinematic, quaternion, DH parameters
Conference Title : ICMEIM 2025 : International Conference on Mechanical Engineering and Industrial Manufacturing
Conference Location : London, United Kingdom
Conference Dates : February 10-11, 2025