

ABSTRACT

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Title : Implementation of Inverse Kinematics and PID Control for Mecanum Wheels Mobile Robot Movement

Advancements in mobile robot locomotion technology have encouraged the adoption of mecanum wheels to improve movement flexibility and efficiency. Conventional drive systems such as differential drive are limited in performing omnidirectional maneuvers, making them less suitable for complex paths like zigzag or parabolic trajectories. This research implements the inverse kinematics method to calculate each wheel's angular velocity based on translational input V_r and directional input θ , and applies PID control to maintain speed stability. The system is combined with an MPU9250 magnetometer sensor for heading correction. Test results show that the robot can move in angular directions from 0° to 315° , with average wheel speed errors reduced from 0.9–1.1 rad/s to 0.4–0.5 rad/s after applying PID control. The average directional deviation also decreased from 9.6° to 4.3° , while heading correction reduced orientation error to an average of 1.9° . These findings demonstrate that the integration of inverse kinematics and PID control effectively improves the accuracy and stability of mecanum-wheeled mobile robot movement.

Keywords: *Inverse Kinematics, PID Control, Heading Correction, Mobile Robot, Mecanum Wheels, Wheel Slip*