Abstract

An important issue in robotics research is path tracking control where the robot is required to follow a certain path. The error between the desired path and the actual path is to converge to zero. This problem is more complicated when the robot dynamics is considered. This paper proposes a real time trajectory tracking control for a differential drive wheeled mobile robot (DDWMR) in obstacle-free environment. The robot is guided to follow certain reference path with a pre-calculated velocity profile. The controller design and analysis of the system stability are guaranteed using Lyapunov stability theory. The dynamic model of real DDWMR is derived and used in the LabVIEW simulation environment for testing the validity of designed controller. The obtained simulation results illustrate the success of the proposed controller. Also to Test the effectiveness of proposed controller, a comparison study with a widely used backstepping based controller is performed.

References
1. G. Yuan, S. Yang, and G. Mittal, Tracking control of a mobile robot using a neural
dynamics based approach, Proceedings 2001 ICRA. IEEE International Conference on
Robotics and Automation (Cat. No.01CH37164).

2. T. Dierks and S. Jagannathan, Control of Nonholonomic Mobile Robot Formations:
Backstepping Kinematics into Dynamics, 2007 IEEE International Conference on Control

3. I. Benaoumeur, B. Laredj, H. E. A. Reda, and A.-F. Zoubir, Backstepping Approach for
Autonomous Mobile Robot Trajectory Tracking, Indonesian Journal of Electrical Engineering


5. J.-M. Yang and J.-H. Kim, Sliding mode control for trajectory tracking of nonholonomic

6. A. Ollero, A. G. Cerezo, and J. V. Martinez, Fuzzy supervisory path tracking of mobile

7. A. Pandey and D. R. Parhi, Optimum path planning of mobile robot in unknown static and
dynamic environments using Fuzzy-Wind Driven Optimization algorithm, Defence Technology,

8. J. Velagic, N. Osmic, and B. Lacevic, Design of Neural Network Mobile Robot Motion

9. M. K. Singh and D. R. Parhi, Intelligent neuro-controller for navigation of mobile robot,
Proceedings of the International Conference on Advances in Computing, Communication and

10. Y. Tian and N. Sarkar, Control of a Mobile Robot Subject to Wheel Slip, Journal of

11. N. Sarkar, X. Yun, and V. Kumar, Control of Mechanical Systems With Rolling

12. R. Fierro and F. Lewis, Control of a nonholonomic mobile robot: backstepping
kinematics into dynamics, Proceedings of 1995 34th IEEE Conference on Decision and Control.

Index Terms

Computer Science

Control Systems

Keywords
Trajectory tracking, nonholonomic robots, dynamic Modeling, differential drive, Lyapunov stability, mobile robot