

Mobile robot navigation using PSO-optimized fuzzy artificial potential field with fuzzy control

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Abstract: The objective of this paper is to develop a path planning algorithm that is able to plan the trajectory of mobile robots from its start point to target point in static and dynamic unknown environments. The classical artificial potential field (APF) method is not sufficient and ineffective for that purpose since it has the problem of local minima. To enhance the performance of the classical APF algorithm and to produce a more efficient and effective path planning for mobile robots, a new method based on combination of a modified APF algorithm with fuzzy logic (i.e. FAPF) is proposed. The proposed algorithm is designed to overcome the problems of the classical APF especially the local minima and enhances the navigation in complex environments. The fuzzy logic controller (FLC) is also used for motion control of the mobile robot. The membership functions of the FLC are optimized with particle swarm optimization (PSO) algorithm for optimality. Simulation models for the proposed path planning and motion control methods are built with MATLAB. Simulation results are obtained and proved that the robot with FAPF navigates with smoother path, react much faster in static and dynamic environments, and avoid obstacles efficiently. The work is compared with other implementations that used conventional PID controllers. All the system is then implemented practically to prove the proposed algorithms and tested in complex and unknown environment.

Keywords: Path planning, fuzzy logic, artificial potential field, fuzzy artificial potential field, PSO

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