

A Development of Holonomic Mobile Robot Using Fuzzy Multi-Layered Controller

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Abstract : In this paper, a holonomic mobile robot is designed in omnidirectional wheels and an adaptive fuzzy controller is presented for its precise trajectories. A kind of adaptive controller based on fuzzy multi-layered algorithm is used to solve the big parametric uncertainty of motor-controlled dynamic system of 3-wheels omnidirectional mobile robot. The system parameters such as a tracking force are so time-varying due to the kinematic structure of omnidirectional wheels. The fuzzy adaptive control method is able to solve the problems of classical adaptive controller and conventional fuzzy adaptive controllers. The basic idea of new adaptive control scheme is that an adaptive controller can be constructed with parallel combination of robust controllers. This new adaptive controller uses a fuzzy multi-layered architecture which has several independent fuzzy controllers in parallel, each with different robust stability area. Out of several independent fuzzy controllers, the most suited one is selected by a system identifier which observes variations in the controlled system parameter. This paper proposes a design procedure which can be carried out mathematically and systematically from the model of a controlled system. Finally, the good performance of a holonomic mobile robot is confirmed through live tests of the tracking control task.

Keywords : fuzzy adaptive control, fuzzy multi-layered controller, holonomic mobile robot, omnidirectional wheels, robustness and stability.

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