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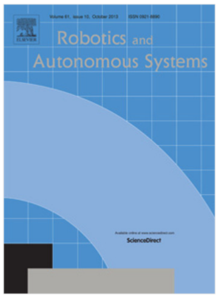

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Robust adaptive neural network-based trajectory tracking control approach for nonholonomic electrically driven mobile robots

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Abstract

This paper presents a robust intelligent controller to be applied to a class of nonholonomic electrically driven mobile robots. This class of robotic systems has an inherent sensitivity to high degree time-varying parametric uncertainties, unmodeled dynamics, and external disturbances. Furthermore, the effects of coupling terms between the mechanical subsystem and the electrical subsystem may cause severe degradations due to the time-varying variations of DC motors and mechanical structure components around their nominal values. To overcome the effects of all these quantities, the robust adaptive neural network tracking controller developed here introduces adaptive laws to estimate a local upper bound of each subsystem of the nonholonomic mobile robot, then, these laws are used on-line as controller gain parameters in order to robustly improve the transient response of the closed-loop system and reduce conservative, in the sense that the local upper bounds to characterize the corresponding uncertainties dynamics for each subsystem, initially computed based on the worse-case scenario, are not updated during the effective control of the mobile robot. In fact, even if more data become available, then they are avoided when estimating local upper bounds, and hence, the level of uncertainty is considerably decreased. According to the universal approximation theorem and the Lyapunov stability theory, the proposed intelligent controller guarantees global stability in the sense that all the states and signals of the closed-loop system, and the trajectory tracking errors are

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