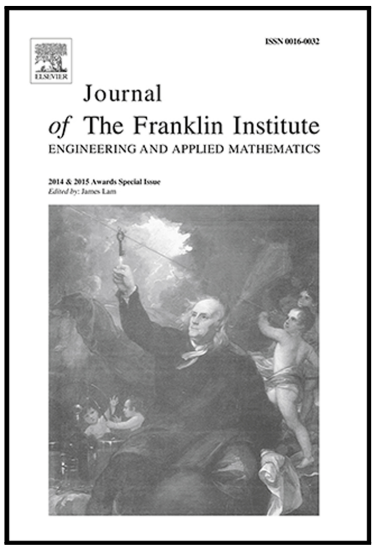

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Cooperative Surrounding Control with Collision Avoidance for Networked Lagrangian Systems

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Abstract

This paper investigates the cooperative surrounding control problem for networked multi-agent systems with nonlinear Lagrangian dynamics. With the consideration of the target with constant and time-varying velocity, two cooperative surrounding control algorithms with collision avoidance are proposed, in which possible collision among agents is prevented so as to achieve a more reliable and safer performance. For the case when the target has a constant velocity, a velocity observer is designed firstly for each agent. Secondly, to handle the nonlinear dynamics and avoid collisions, the neural networks and potential functions are used for the controller design. Then, the cooperative surrounding control algorithm is proposed such that all the agents surround the target with the desired configuration. For the case when the target has a time-varying velocity, the velocity observer is designed under the assumption that the target's partial acceleration is known for each agent. Then, the cooperative surrounding control algorithm is proposed such that the surrounding error between the target and each agent is bounded. The main difference between these two algorithms is that the former can ensure the collision avoidance among target and agents, while the latter can do so only among agents because of the time-varying of the target velocity. The Lyapunov theory is used to prove the stability of the cooperative surrounding control algorithms. The simulation illustrates the effectiveness of the theoretical results.

Index Terms

Cooperative surrounding control; multi-agent systems; collision avoidance; Lagrangian system.

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