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Brief paper

Saturated formation containment control for a heterogeneous multi-agent system with unknown perturbations ☆

Jaime González-Sierra [a], Mario Ramirez-Neria [b], Jesus Santiaguillo-Salinas [c], Eduardo G. Hernandez-Martinez [b]

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Abstract

This work addresses formation containment control for a heterogeneous multi-agent system composed of first-order (FO) and second-order (SO) agents that can be either leader or follower agents. It is assumed that unknown but bounded disturbances perturb its dynamical model. An error-based version of a generalized proportional–integral observer (GPIO) is proposed to estimate these perturbations, and saturation functions, based on position measurement and estimated velocity errors, are designed to achieve the control objective. Specifically, it is shown that the leader agents converge to a desired geometric pattern following a desired trajectory simultaneously. Furthermore, the follower agents converge to the convex hull spanned by the leaders. The result applies to a group of robots in which a directed spanning tree gives the communication topology among the leaders with a root in the main leader. At the same time, each follower receives information from at least one leader agent, and the communication is directed. Real-time experiments and a comparison with a robust control technique exhibit the excellent performance of the proposed GPIO and control strategy in achieving formation containment control.