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Saturated Finite-Time Control for Uncertain Multiagent Systems with Uncertainties and Disturbances

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Introduction

Multiple autonomous agents are utilized to carry out many complicated tasks in recent decades, such as surveillance and rescue, monitoring environments and object transportation, etc.

Research objectives

Control objective: with the above preparation in hand, the control objective in this paper is to construct adaptive control protocols for the follower agent such that the formation errors e_{xi} and e_{vi} for $i = 1, 2, \ldots, n$, are steered to zero, i.e., $e_{xi} = 0$ and $e_{vi} = 0$, in a finite time t_f in spite of structured uncertainties and unstructured external disturbances.

Controller

the resulting error dynamics of multiagent systems is

$$\dot{e}_x = e_v$$

$$\dot{e}_v = g(p,v)u + \theta^T \varphi(p,v) + w(t)$$

Theorem: Consider a group of multiagent systems, the control objective is achieved, i.e., the specified formation is achieved in finite time under the action of by the *i*th follower.

$$u_i = -\frac{1}{g(p,v)}(ce_v + sat_\delta(K_1 s(p,v))$$

$$+ sat_\delta(|K_1 s(p,v)|^{\frac{1}{2}})\mathrm{sgn}(K_1 s(p,v))$$

Results

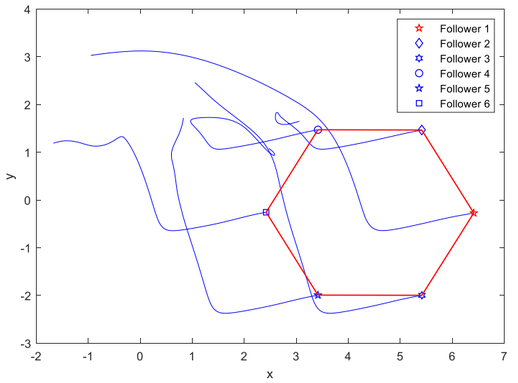

Fig. 1 The desired formation.

Conclusion

A boundary layer for the saturation-like function is properly chosen and its corresponding open set is obtained by carrying out the simulation, and the switching condition on the proposed controller is derived.

M. -L. Chiang, Y. -W. Chen, C. -S. Chen and S. -H. Tsai, "Distributed Formation Control of Multiagent Systems With Specified Order," IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 52, no. 1, pp. 301-310, Jan. 2022.