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Editorial

Modeling, analysis and control of networked autonomous agents

Motivated by the broad applications of networked autonomous agents, the problems of modeling, analysis and coordinated control are being actively studied across different fields of science and engineering. Examples of networked autonomous agents in nature and society include flocks of birds, schools of fish, swarms of bacteria, and crowds of human being. Research on the mechanisms of cooperative behaviors is due not only to comprehending natural behaviors but also to developing artificial autonomous systems.

This special issue focuses on theoretical and technological achievements in modeling, analysis and control of networked autonomous agents, specifically within the following four areas: modeling and analysis of complex dynamical networks; coordinated control and controllability of multi-agent systems; distributed control and estimation of sensor networks; optimal swarming of multi-agent systems and applications of networked autonomous agents. It contains twenty-two papers, the contents of which are summarized below.

In the area of modeling and analysis of complex dynamical networks, Zhang et al. investigate the switching topologies for a few specific quadrotor UAV formations in 'Switching topology approach for UAV formation based on binary-tree network'. A decentralized state estimation method for the control of network systems, with a cooperative objective to be achieved, is studied by Boem et al. in 'Decentralized state estimation for the control of network systems'. In 'A cyclic pursuit framework for networked mobile agents based on vector field approach' by Rezaee and Abdollahi, a pursuit formation control scheme for a network of double-integrator mobile agents is investigated from a vector-field approach. Rehák and Lynnyk study the control problem of coupled nonlinear identical systems that admit full and exact feedback input-output linearization in 'Network-based control of nonlinear large-scale systems composed of identical subsystems'. In 'Global consensus tracking of discrete-time statured networked systems via nonlinear feedback laws', Wang and Wang study the coordinated tracking of networked systems in the presence of input saturation.

Regarding coordinated control and controllability of multi-agent systems, Yang et al. study a compounded fractional-order multi-agent system with diverse dynamical equations in 'Containment control of heterogeneous fractional-order multi-agent systems'. Zhang et al. in-

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vestigate the consensus-based total-amount cooperative tracking control in 'Consensus-based total-amount cooperative tracking control for multi-motor of locomotive traction system'. In 'Finite-time and fixed-time bipartite consensus of multi-agent systems under a unified discontinuous control protocol', Liu et al. investigate the issues of finite/fixed-time bipartite consensus of multi-agent systems with signed graphs. Fan et al. address the question of semi-global leader-following coordination of general linear multi-agent systems, in which the control input of each agent is steered by an aperiodically intermittent saturated actuator, in 'Semi-global leader-following coordination of multi-agent systems with input saturation and aperiodic intermittent communications'. Baldi and Frasca investigate the synchronization of heterogeneous linear agents with unknown dynamics in 'Adaptive synchronization of unknown heterogeneous agents: An adaptive virtual model reference approach'. In 'Finite-time consensus of neutrally stable multi-agent systems in the presence of input saturation', Zhang et al. investigate the problem of finite-time consensus of linear multi-agent systems subject to input saturation, with two control protocols presented for leaderless and leader-following cases, respectively.

In the study of distributed control and estimation of sensor networks, Lu et al. consider a cooperative optimal preview tracking problem for continuous-time descriptor multi-agent systems with a directed topology containing a spanning tree, in 'Cooperative optimal preview tracking for linear descriptor multi-agent systems'. The robust stability problem of a multi-agent system moving to a desired rigid formation in the presence of unknown time-varying communication delays and actuator faults is investigated by González et al. in 'Robust stability analysis of formation control in local frames under time-varying delays and actuator faults'. Jenabzadeh and Safarinejadian study the control problem of nonholonomic multi-agent systems with external disturbances, which track a target with state information that is not available to any agent, in 'Distributed estimation and control of multiple nonholonomic mobile agents with external disturbances'. In 'Consensus disturbance rejection with event-triggered communications', Cheng and Li discuss the consensus disturbance rejection problem of networks of linear agents with event-triggered communications in the presence of matched disturbances. Qin et al. investigate a distributed sensor fault detection and isolation scheme for a network of second-order integrators in 'Distributed sensor fault diagnosis for a formation of multivehicle systems'.

Concerning optimal swarming of multi-agent systems and applications of networked autonomous agents, Yang et al. study the adaptive optimization problem of continuous-time multi-agent systems in 'Adaptive distributed convex optimization for multi-agent and its application in flocking behavior'. Weng et al. investigate a distributed projection algorithm based on the sub-gradient method to solve the distributed optimization problem with a constrained set over a directed multi-agent network, in 'Distributed optimization with closed convex set for multi-agent networks over directed graphs'. The problem of adaptive synchronization for coupled harmonic oscillators with switching topology is investigated by Xu et al. in 'Adaptive synchronization of coupled harmonic oscillators under switching topology'. Zhu and Guo examine the coordinated attitude control for spacecraft formation, subject to saturating actuators and unknown inertia, by virtue of an adaptive strategy, in 'Adaptive coordinated attitude control for spacecraft formation with saturating actuators and unknown inertia'. Qi et al. study a clustering flying ad-hoc sensor networks architecture with software defined networking cluster controllers in 'A traffic-differentiated routing algorithm in flying ad hoc sensor networks with SDN cluster controllers'. Song et al. investigate a quaternion-based finite-time cooperative attitude synchronization and tracking of multiple rigid spacecraft with a virtual leader, subject

to bounded external disturbances, in 'Chattering-free full-order recursive sliding mode control for finite-time attitude synchronization of rigid spacecraft'.

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