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Model-Free Distributed Control of Dynamical Systems

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Abstract : Distributed control is an efficient and flexible approach for coordination of multi-agent systems. One of the main challenges in designing a distributed controller is identifying the governing dynamics of the dynamical systems. Data-driven system identification is currently undergoing a revolution. With the availability of high-fidelity measurements and historical data, model-free identification of dynamical systems can facilitate the control design without tedious modeling of high-dimensional and/or nonlinear systems. This paper develops a distributed control design using consensus theory for linear and nonlinear dynamical systems using sparse identification of system dynamics. Compared with existing consensus designs that heavily rely on knowing the detailed system dynamics, the proposed model-free design can accurately capture the dynamics of the system with available measurements and input data and provide guaranteed performance in consensus and tracking problems. Heterogeneous damped oscillators are chosen as examples of dynamical system for validation purposes.

Keywords : consensus tracking, distributed control, model-free control, sparse identification of dynamical systems
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