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Cooperative output regulation for a network of parabolic systems with varying parameters.

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Summary: This paper is concerned with the cooperative output regulation problem for a network of agents with different dynamics described by parabolic PDEs subject to spatially- and time-varying parameters. Firstly, a networked controller is designed achieving output synchronization for identical finite-dimensional reference models, which deliver the state of the global reference model required for the synchronization to the parabolic agents. The latter can be subject to local disturbances acting in-domain, on all boundaries and on the anti-collocated output to be controlled. The cooperative output regulation problem is solved by designing local output feedback regulators for the parabolic agents. This requires the solution of time-varying regulator equations and the design of disturbance observers for parabolic systems with spatially- and time-varying coefficients. For this, a systematic backstepping approach is provided and it is shown that cooperative output regulation with exponential convergence is ensured for the resulting multi-agent system. The results of the paper are applied to the cooperative output regulation of a heterogeneous network of four parabolic agents in the presence of local disturbances.

MSC:
93C20 Control/observation systems governed by partial differential equations
35K40 Second-order parabolic systems
93A16 Multi-agent systems
93B70 Networked control

Keywords:
parabolic systems; multi-agent systems; cooperative output regulation; backstepping; boundary control

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