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Summary: We introduce here a simple finite-dimensional feedback control scheme for stabilizing solutions of infinite-dimensional dissipative evolution equations, such as reaction-diffusion systems, the Navier-Stokes equations and the Kuramoto-Sivashinsky equation. The designed feedback control scheme takes advantage of the fact that such systems possess finite number of determining parameters (degrees of freedom), namely, finite number of determining Fourier modes, determining nodes, and determining interpolants and projections. In particular, the feedback control scheme uses finitely many of such observables and controllers. This observation is of a particular interest since it implies that our approach has far more reaching applications, in particular, in data assimilation. Moreover, we emphasize that our scheme treats all kinds of the determining projections, as well as, the various dissipative equations with one unified approach. However, for the sake of simplicity we demonstrate our approach in this paper to a one-dimensional reaction-diffusion equation paradigm.

MSC:
35Q93 PDEs in connection with control and optimization
35K25 Reaction-diffusion equations
37L25 Inertial manifolds and other invariant attracting sets of infinite-dimensional dissipative dynamical systems
37L30 Attractors and their dimensions, Lyapunov exponents for infinite-dimensional dissipative dynamical systems
37N35 Dynamical systems in control
93B52 Feedback control
93C20 Control/observation systems governed by partial differential equations
93D15 Stabilization of systems by feedback
76D05 Navier-Stokes equations for incompressible viscous fluids

Keywords:
reaction-diffusion; Navier-Stokes equations; feedback control; data assimilation; determining modes; determining nodes; determining volume elements

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References:
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