Author:

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Title:

Tracking control for PDEs in single and higher dimensions

Abstract:

Partial differential equations (PDEs) arise in a broad variety for the mathematical description of dynamic systems. Examples include smart structures, fixed–bed reactors, fluid flow, and even interconnected multi–agent systems. Their operation relies on the integration of suitable control strategies, e.g., to suppress vibrations, to avoid and detect hot spots or to stabilize formations. Complementing the feedback stabilization in the last years systematic motion planning and tracking control concepts to impose a desired transient behavior have gained increasing interest both in control theory and applications.

This contribution addresses recent developments for the tracking control of PDE systems in single and higher dimensional spatial domains. This will include flatness–based methods for motion planning and feedforward control as well as backstepping–based feedback control and observer design. It will be shown that their combination leads to stabilizing tracking controllers, even for certain classes of nonlinear PDEs, to achieve a prescribed desired spatial–temporal evolution of the state variables. The applicability and control performance of the developed design techniques will be illustrated in numerical simulations for diffusion–convection–reaction systems and, by exploiting a continuum approach, for coupled multi–agent systems.