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Boundary Stabilization of a Parabolic-Elliptic System Using Backstepping Approach

We consider the boundary stabilization of a parabolic partial differential equation coupled with an elliptic partial differential equation. Even in the situation when these equations are exponentially stable when uncoupled, the coupled system may be unstable. In fact, increasing the coupling factor tends to destabilize the dynamics of the system. A backstepping approach is used to design a boundary control that will stabilize the system, or more generally, improve the decay rate in the situation when the original system is stable. The result is illustrated with simulations.