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Duality in Distributed-Parameter Control of Nonconvex and Nonconservative Dynamical Systems with Applications

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Abstract: Based on a newly developed canonical dual transformation methodology, this paper presents a potentially useful duality theory and method for solving fully nonlinear distributed-parameter control problems. The extended Lagrange duality and the interesting triality theory proposed recently in finite deformation theory are generalized into nonconvex dissipative Hamiltonian systems. It is shown that in canonical dual phase space, the solutions of chaotic systems form an invariant set. Thus, an important bifurcation criterion is proposed, which leads to an effective dual feedback control against chaotic vibrations. Applications are illustrated by a large deformation "smart" beam structure with both shear/damping actuators, and a dissipative Duffing system.

Keywords: *Duality; control theory; chaos; nonconvex analysis; Hamiltonian system.*

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