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Optimal control of a mechanical system with play

We study the stabilization of a second order differential equation with control occurring through a play operator. This is a model for a mechanical system such as a shaft or gear system with mechanical play on the fittings. Since the differential equation is discontinuous in the state variable the usual existence theory does not apply. It is shown directly that a Caratheodory solution exists for all continuous controls. An optimal control problem of minimizing a cost associated with these dynamics is formulated. It is shown that a viscosity solution to the Hamilton–Jacobi–Belman PDE exists, and hence an optimal control. A scheme for computation of the optimal control is presented along with some numerical results.

This is joint work with Carmeliza Navasca, Clarkson University.