Optimal control for coupled sweeping process under minimal assumptions

Vera Zeidan, Michigan State University

Joint work with Samara Chamoun, Michigan State University

Contact: zeidan@msu.edu

A sweeping process refers to a dynamical system represented by a differential inclusion involving the normal cone to a nicely moving closed set $C(t)$, called the sweeping set. Consequently, the right-hand-side of this differential inclusion is discontinuous and unbounded, and hence, the standard differential inclusions results do not apply.

A general model of nonsmooth optimal control problems involving a controlled sweeping process is introduced. It is distinguished by having three main characteristics. First, the sweeping set is nonsmooth, time-dependent, and prox-regular. Second, the sweeping process is *coupled* with a controlled differential equation. Third, joint state-endpoints constraints are present.

Our model incorporates different controlled submodels as particular cases, such as second-order sweeping processes, a class of integro-differential sweeping processes of Volterra-type, coupled evolution variational inequalities (EVI), coupled dynamical variational inequalities (DVI), and Bolza-type problems over a sweeping process.

In this talk we explain how a modification of the exponential-penalty approximation method leads under minimal assumptions to a complete form of the nonsmooth Pontryagin-type maximum principle and to local and global existence of optimal solutions for our general Mayer problem.

The utility of the optimality condition is illustrated with an example.