Moreau-Yosida Regularization of State-Dependent Sweeping Processes with Nonregular Sets

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Let H be a separable Hilbert space. Given a set-valued map $C\colon [T_0,T]\times H \rightrightarrows H$ with nonempty closed values, the perturbed state-dependent sweeping process is the differential inclusion:

$$\begin{cases} -\dot{x}(t) \in N\left(C(t,x(t));x(t)\right) & \text{a.e. } t\in[T_0,T],\\ x(T_0)=x_0\in C(T_0,x_0), \end{cases} \tag{1}$$

where for any subset $S\subset H$ the set $N(S;u)$ is the Clarke normal cone to S at $u\in S$. This differential inclusion is motivated by quasivariational inequalities arising, e.g., in the evolution of sandpiles, quasistatic evolution problems with friction, micromechanical damage models for iron materiales, etc.

To deal with (1), for $\lambda>0$ let x_λ be any solution of the following penalized differential inclusion:

$$\begin{cases} -\dot{x}_\lambda(t) \in \dfrac{1}{2\lambda}\partial d^2_{C(t,x_\lambda(t))}\left(x_\lambda(t)\right) & \text{a.e. } t\in[T_0,T],\\ x_\lambda(T_0)=x_0\in C(T_0). \end{cases} \tag{$\mathcal{P}_\lambda$}$$

In this talk, we show the convergence strongly pointwisely (up to a subsequence) of $(x_\lambda)_\lambda$ towards a solution of (1) when the moving sets are nonregular (subsmooth and positively α-far). Some relevant consequences are indicated.

Keywords: Sweeping process, Moreau-Yosida Regularization, Positively α-far sets, Subsmooth sets.

References

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