

# Necessary Conditions for Optimal Control Problems with Sweeping Systems

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## ABSTRACT

This talk focuses on the derivation of necessary conditions for optimal control problems involving sweeping systems with moving sets. These are systems defined by the differential inclusion

$$\dot{x}(t) \in f(t, x(t), u(t)) - N_C(x(t)), \quad (1)$$

where  $N_C$  is the normal cone to a set  $C$ . Noteworthy, the presence of the normal cone  $N_C$  destroys the regularity under which necessary conditions are derived. In [1] necessary conditions in the form of a Maximum Principle were derived assuming the set  $C$  to be time independent. A remarkable feature of [1] was the introduction of a special family of continuous approximation systems to (1). In this talk we show how such family of continuous approximation systems can be of help to extend the results in [1] to sweeping systems with moving set (i.e., when the set  $C$  is time dependent). We go a step further considering also optimal control problems with end point constraints.

This is a joint work with *M. Margarida A. Ferreira* from *Universidade do Porto* and *Georgi Smirnov* from *Universidade do Minho*.

## References

- [1] Set-Valued Var. Anal 27, 523548. M. d. R. de Pinho, M. M. A. Ferreira and G. V. Smirnov, *Optimal Control involving Sweeping Processes*, Set-Valued Var. Anal 27, 523548. Vol. 1 (1), pp. 1323–1350, 2019.