

# Hybrid maximum principle with regional switching parameter

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**Abstract:** In this presentation, we consider a Mayer optimal control problem where the controlled system is defined over a partition of the euclidean space, and we assume that the dynamics depends on some additional regional switching parameter. This means that the parameter should remain constant over every stratum (but not necessarily constant over the time period). This framework is motivated by several applications arising in the context of aerospace engineering or in epidemiology (typically when a loss of control occurs). Our objective is to derive the necessary optimality conditions, in the form of a Pontryagin' principle. We shall see in this presentation how to obtain such conditions thanks to regional needle perturbations and to a careful sensitivity analysis in this hybrid setting. Furthermore, we present an application of this framework in the case of non permanent control (typically when a control loss occurs on certain regions).

## References:

- [1] T erence Bayen and Anas Bouali and Lo ic Bourdin, *Hybrid maximum principle with regional switching parameter*, preprint HAL, 2022.
- [2] T erence Bayen and Anas Bouali and Lo ic Bourdin, *Optimal control problems with non-control regions: necessary optimality conditions*, 2022.