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Special Session: Optimal Control

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Title: Geometric optimality conditions for trajectories containing a singular arc, Part I.

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Abstract: We consider different optimal control problems associated to an affine system on a n -dimensional C^∞ manifold M :

$$\begin{cases} \dot{\xi}(t) = (f_0 + \sum_{i=1}^m u_i(t) f_i) \circ \xi(t) \\ \xi(0) \in N_0, \quad \xi(T) \in N_f \\ (u_1, \dots, u_m) \in L^\infty(\mathbb{R}, U) \end{cases}$$

where N_0 and N_f are C^∞ sub-manifolds of M , f_0, \dots, f_m are C^∞ vector fields, the control set U is a box and the final time T may be either fixed or a variable.

We consider the case when the candidate optimal trajectory contains both bang-bang arcs and a singular (or partially singular) arc.

We explain how the Hamiltonian approach can be applied in this case thanks to the development of the theory under some "minimal regularity assumptions" and the introduction of a "super Hamiltonian" (i.e. a Hamiltonian which is greater than or equal to the maximized one).

Finally we give a coordinate-free non degenerate second variation when the singular arc satisfies the strong generalized Legendre condition.