

Normality of the maximum principle for optimal control problems under state constraints

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Abstract

Necessary optimality conditions for optimal control problems under state constraints may happen to be abnormal and even degenerate. In particular if a feasible trajectory of a control system starts from the boundary of constraints, then it is always possible to associate to it a degenerate maximum principle. To restrict the number of potential candidates for optimality, several authors proposed sufficient conditions allowing to associate a non degenerate maximum principle to every optimal solution. These sufficient conditions involve the inward pointing admissible velocities on the boundary of constraints. In this lecture the question of normality of maximum principles will be discussed both when the initial condition is fixed or when it is restricted to a subset. Normality of necessary optimality conditions is very useful to derive Lipschitz regularity of optimal trajectories and/or of optimal controls under the Tonelli growth condition. Actually it can be also used to derive such regularity of optimal solutions also for Lagrangians without the superlinear growth.