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Some Analytical Tools in State Constrained Optimal Control

Abstract: Consider a deterministic control system with an accompanying state constraint set. Estimates on the distance of a given process from the set of processes that satisfy a specific state constraint in terms of the state constraint violation of the nominal process have an important role in state constrained optimal control theory.

In the literature, these results have been referred to as 'existence of feasible approximating trajectory estimates' or 'Filippov type theorems'. They have been employed to ensure the validity of the Maximum Principle in normal form, to establish regularity properties of the value function, to justify interpreting the value function as a unique solution of the Hamilton-Jacobi equation, and for other purposes. A range of estimates are required, which differ according the metrics used to measure 'distance' and the modulus of state constraint violation, in terms of which the estimates are expressed.

Recent research has shown that simple linear estimates are valid when the state constraint set has smooth boundary, but the picture becomes much more complicated when the boundary of the state constraint set has corners.

We trace a short history about Filippov type results, including a number of recent developments, examples, applications and open questions (the latter concerns also stochatsic control).