Normality of generalized Euler-Lagrange conditions for state constrained optimal control problems

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We consider state constrained optimal control problems in which the cost to minimize comprises both integral and end-point terms, establishing normality of the generalized Euler-Lagrange condition. Simple examples illustrate that the validity of the Euler-Lagrange condition (and related necessary conditions), in normal form, depends crucially on the interplay between velocity sets, the left end-point constraint set and the state constraint set. We show that this is actually a common feature for general state constrained optimal control problems, in which the state constraint is represented by closed convex sets and the left end-point constraint is a closed set. In these circumstances classical constraint qualifications involving the state constraints and the velocity sets cannot be used alone to guarantee normality of the necessary conditions. A key feature of this result is to prove that the additional information involving tangent vectors to the left end-point and the state constraint sets can be used to establish normality.

Références

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