

First and Second-Order Conditions for Strong Local Minimum in Control Problems with State Constraints

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Abstract

First- and second-order optimality conditions for strong local minimum are presented for optimal control problems with pure state set-inclusion constraints. The first-order condition is of Pontryagin type, while the second-order condition is of the form of an accessory problem associated with the strong local minimality. This latter condition contains an extra term reflecting the presence of the pure state constraints. The approach uses the time transformation method introduced by Dubovitskii and Milyutin in 1963 that transforms the original control problem into an auxiliary control problem such that the optimality in the original problem yields the optimality in the auxiliary problem of the transformed solution. Furthermore, when the first-order weak local optimality conditions are applied to the auxiliary problem, then one can deduce the Pontryagin principle as well as second-order necessary conditions for the strong local optimality for the original problem.

Key Words: First- and second-order strong local optimality conditions, Critical cone, Critical tangent cone, Set-valued constraints