

Goh and Legendre-Clebsch conditions for nonsmooth control systems

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Higher order necessary conditions for a minimizer of an optimal control problem are generally obtained for systems whose dynamics is continuously differentiable in the state variable. In a recent paper in collaboration with Franco Rampazzo, by making use of the notion of set-valued Lie bracket, introduced by Franco Rampazzo and Hector Sussmann in 2001, we obtain Goh and Legendre-Clebsch type conditions for a control affine system with Lipschitz continuous dynamics. In order to manage the simultaneous lack of smoothness of the adjoint equation and of the Lie bracket-like variations, we make use of the notion of Quasi Differential Quotient, introduced by Michele Palladino and Franco Rampazzo in 2020. We also show exhibit some examples where the established higher order condition is capable to rule out the optimality of a control verifying a first order Maximum Principle.

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