

Necessary conditions in optimal control problems with integral equations

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Abstract

We consider an optimal control problem with a Volterra type integral equation subject to endpoint, mixed state-control and pure state constraints.

We prove necessary optimality conditions that generalize Euler–Lagrange equation in the classical calculus of variations and Pontryagin Maximum Principle (MP) for problems with ODEs. The proof of MP is based on an extension of the control system by introducing sliding mode controls and using a relaxation theorem that allows to approximate solutions of the extended system by solutions of the original system.

In the case of variable time interval we reduce the problem to a problem on a fixed time interval, which leads to a more general type of integral equation than the standard Volterra type, and this is the cause of appearance of the new additional terms in the costate equation and transversality conditions with respect to the time variable, that are absent in problems with ODEs.

Based on joint work with Nikolai Osmolovskii.

References

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