Gradient-types Methods Revisited in Optimal Control Problems with Bang-Bang Solutions

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Abstract: Discretization schemes for optimal control problems with continuous controls have been well investigated in the last decades. Contrasty, optimal control problems with bang-bang solutions, which appear frequently in practical problems, attract less attentions. Recently, some progress in discretization schemes for linear-quadratic optimal control problems with bang-bang solutions have been made. However, only a few numerical algorithms for solving the discretized problems are investigated. In this talk, we discuss some numerical algorithms for solving these discretized problems.

In the first part of the talk, when the Euler's discretization technique is applied, we discuss the gradient projection method. It is shown that the iterative sequence generated by the gradient projection method converges linearly to an optimal solution of the discretized problem.

In the second part of the talk, we consider a new numerical discretization technique introduced recently by T. Scarinci and V. Veliov, which doubles the error estimate of the Euler's discretization. For this numerical scheme, the discretized problem is re-written as an optimization problem involving convex objective function and strongly convex constraint. For solving the resulted problem, we apply two methods: The gradient projection method and the conditional gradient method. The linear convergence of both methods is obtained under reasonable assumptions for the optimal control problems with bang-bang solutions. Finally, some numerical experiments are performed confirming the theoretical results.

This talk is based on joint works with J. Preininger and V. Veliov.

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