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On the convergence of discretizations of higher index DAE optimal control problems

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Direct discretization methods for optimal control problems enjoy great popularity in solving problems in practical applications owing to their user friendliness and robustness and their ability to return results even for difficult problems with control and state constraints. Mathematically, it is desirable to support (and thus to justify) the direct discretization methods by the investigation of convergence properties of the solutions of the discretized problems to the solution of the continuous problem, compare [1, 2].

In this talk we particularly focus on convergence properties of discretizations of optimal control problems subject to differential-algebraic equations (DAEs) of index two, which arise, e.g., in mechanical engineering (using appropriate stabilization techniques) or in process engineering.

In order to establish the convergence of solutions of the discretized problems to a solution of the continuous problem, we exploit the necessary conditions of both, the discretized problems and the continuous problem. Unfortunately there is a structural discrepancy between the continuous and discrete necessary conditions, which needs to be addressed. We identify conditions under which the discrepancy can be overcome and establish the first order convergence of the implicit Euler method.

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