Optimal Control of Descriptor Systems

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Abstract: We discuss optimal control problems for general unstructured nonlinear differential-algebraic equations of arbitrary index. This problem has been an open problem for more than 30 years due to the fact that the solvability theory is very complex.

We present some real world examples where such problems arise in flow control as well as multibody dynamics. We then derive necessary optimality conditions, first in the case of linear-quadratic control problems and then for the general nonlinear case. We also present a Pontryagin maximum principle for general unstructured nonlinear DAEs in the case of restricted controls.

Moreover, we discuss the numerical solution of the resulting optimality boundary value problems and present numerical examples.

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