

NUMERICAL SOLUTION OF OPTIMAL CONTROL PROBLEMS FOR DESCRIPTOR SYSTEMS

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Abstract

We discuss optimal control problems for general unstructured linear differential-algebraic equations of arbitrary index. We discuss controllability and observability in the higher order case and show that order reduction may lead to false results. We then derive necessary conditions in the case of linear-quadratic control problems and show how these lead to eigenvalue problems for even matrix polynomials.

We discuss the numerical solution of these structured eigenvalue problems and present some examples.

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References

- [1] R. BYERS, V. MEHRMANN AND H. XU, *A structured staircase algorithm for skew-symmetric/symmetric pencils*, Preprint 260, MATHEON, DFG Research Center *Mathematics for key technologies* in Berlin url: <http://www.matheon.de/> To appear in *Electronic Transactions on Numerical Analysis*, 2006.
- [2] P. KUNKEL AND V. MEHRMANN, *Necessary and sufficient conditions in the optimal control for general nonlinear differential-algebraic equations*, Preprint 355, MATHEON, DFG Research Center *Mathematics for key technologies* in Berlin url: <http://www.matheon.de/> .
- [3] P. LOSSE AND V. MEHRMANN, *Algebraic characterization of controllability and observability for second order descriptor systems*, Preprint 21–2006, Institut für Mathematik, TU Berlin, 2006. url: <http://www.math.tu-berlin.de/preprints/>
- [4] V. MEHRMANN AND T. STYKEL, *Descriptor systems: a general mathematical framework for modelling, simulation and control*, Preprint 292, MATHEON, DFG Research Center *Mathematics for key technologies* in Berlin url: <http://www.matheon.de/>, *Automatisierungstechnik*, 8 (2006), pp. 405–415.
- [5] V. MEHRMANN AND C. SHI, *Transformation of high order linear differential-algebraic systems to first order*. To appear in *Numerical Algorithms*, 2006/2007.