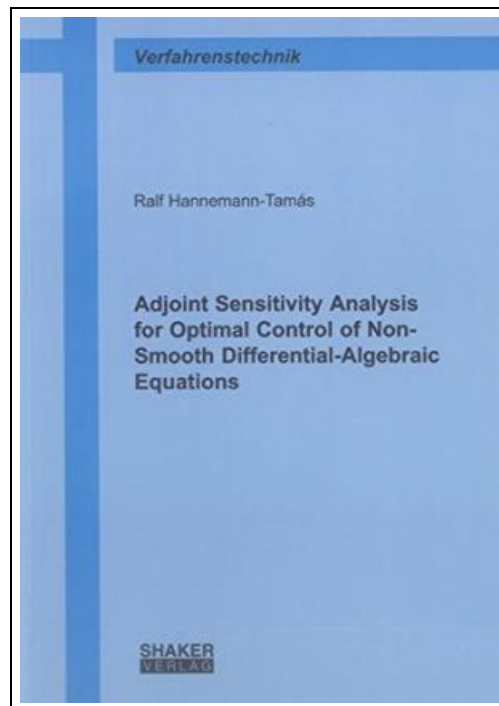


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Shaker Verlag Jan 2013, 2013. Buch. Condition: Neu. Neuware - Numerical methods for optimal control and especially software solutions remain an active research area in the mathematical and engineering community. The intention of this PhD thesis is to contribute to the development of reliable algorithms and software for optimal control and it is therefore focused on the popular direct single shooting method. An important computationally costly part of single shooting is the robust and efficient sensitivity analysis of the parameterized optimal control problems. Hence, to improve single shooting algorithms it is essential to investigate efficient numerical methods for sensitivity analysis. Another essentially open question is how to decide whether a direct single shooting solution sufficiently approximates the true solution of the underlying optimal control problem. Apart from the introduction (Chapter 1) and the summary (Chapter 6), this work contains four chapters which tackle the above mentioned issues. Chapter 2 is devoted to the theory of continuous sensitivity analysis which presents the following novel results: the discovery of composite adjoints to extend the classical adjoint sensitivity analysis to multi-point DAE embedded functionals of type $f(z(t_1), \dots, z(t_N), p)$ where $z(t)$ is the solution of a differential-algebraic equations system; and the development of (higher-order) adjoint equations for non-smooth parametric semi-explicit differential-algebraic equations of index 1. Chapter 3 treats the theory of ODE and DAE constrained control problems, the analysis by means of the continuous necessary conditions of optimality and the verification of the numerical solution by a novel stopping criterion for single shooting. It provides a tailored literature overview and contains some novel contributions. It is discussed how to properly formulate ODE and DAE constrained optimal controls. In this context restrictions on the problem formulation are derived. For DAEs, these restrictions give rise to the classification of algebraic variables as volatile or non-volatile,...



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