Optimal control techniques for contact dynamics

Matthias Gerdts

University of the Bundeswehr Munich  matthias.gerdts@unibw.de

Keywords: optimal control, contact dynamics, Riemann-Stieltjes integrals, numerical treatment

We investigate a class of optimal control problems subject to contact dynamics. Such dynamics particularly arise in mechanical multibody systems with contact forces and friction forces. A major difficulty is to handle the impulsive character of such systems, that is, discontinuities in velocity components, which are among the state variables, may occur.

Simulation techniques frequently use switching functions to detect contact points and update formulas to update the state at a contact point. This approach is practically limited to isolated contact points. An alternative approach employs semi-smooth Newton methods to solve complementarity problems, which arise from a discretization of the dynamic system in each integration step, compare [2].

Within an optimal control problem a reformulation of the dynamic system using Riemann-Stieltjes integrals has some advantages, since this formulation allows to apply discretization schemes suitable for Riemann-Stieltjes integrals, compare [1,3]. This yields the basis for a numerical solution method.

