Simultaneous Direct Approaches for Inverse Optimal Control Problems

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Abstract: Inverse optimal control problems arise in the field of modeling, simulation and optimization of the human gait. For our studies we concider a bilevel optimization problem. The lower optimal control model includes unknown parameters that have to be determined by fitting the model to measurements, which is done in the upper level. The dynamics of biomechanical multi-body systems are mathematically described by a nonlinear differential algebraic equation system. Our goal is to derive optimal control models for the gait of patients with cerebral palsy from real-world motion capture data and provide a diagnostic tool for stratifying these patients for therapeutic options.

In this talk mathematical and numerical methods using a simultaneous direct approach for inverse optimal control problems will be presented and solutions of representative examples for these class of problems will be given. The results of these studies are part of the collaborative project "Numerical Methods for Diagnosis and Therapy Design of Cerebral Palsy by Bilevel Optimal Control of Constrained Biomechanical Multi-Body Systems", which is funded by DFG through the priority program SPP 1962 "Non-smooth and Complementarity-based Distributed Parameter Systems: Simulation and Hierarchical Optimization".

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