Kolloquium Angewandte Mathematik
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der Bundeswehr Universität München

Vortragsankündigung

Am Mittwoch**, den 19.07.2017,** hält **um 17:00 Uhr**

Michael Burger
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einen Gastvortrag über das Thema

Optimal Control Methods in Vehicle Engineering General Considerations and Selected Examples

Der Vortrag findet im **Raum 1301** in **Gebäude 33** statt.

Vortragszusammenfassung

In this talk, we consider the application of optimal control methods in the field of vehicle engineering. In the latter, the considered systems, modern vehicles, are highly complex mechatronic systems, in which subsystems and components from a variety of different physical domains (mechanics, hy- draulics, electrics,...) dynamically interact. The basis of a corresponding mathematical model is typically a multibody system. Mathematically, the model is set up as (nonlinear) ordinary differential equation (ODE) or as a (nonlinear) differential-algebraic equation (DAE). Thus, optimal control methods for this class of systems have to be investigated and applied in a numerically efficient way. We discuss this general situation and, moreover, we present selected specific application scenarios.

The first scenario is the dynamic inversion of mechanical systems using op- timal control methods. Here, the task is to determine input signals (e.g., vertical road profiles) that track certain given reference quantities (displace- ments, accelerations, section forces), which are typically obtained by (test- track-) measurements. This task can be formulated as ODE-/DAE-optimal control problem. Additionally, considering road profiles that excite a vehicle model may also lead to delays in the input. We discuss the problem set-up - (delay-)DAE optimal control problems - and present a solution approach by so called function space methods (projected gradient, Gauss-Newton) as well as some numerical results.

Secondly, we are concerned with the prediction of speed profiles based on geo- referenced data and a longitudinal dynamic vehicle model. Speed profiles are characteristic both for the dynamic loads and for fuel consumption and en- ergy demands, respectively. On a given route in the world, we obtain data (curvature, slope, legal speed limits, traffic-lights,...) from a digital map. The vehicle model accounts for the longitudinal dynamic characteristics of the considered vehicle; driver and traffic are modeled stochastically. We end up with a constrained ODE-optimal control problem of mixed-integer type(due to gear-selection as input). We present a solution strategy by dynamic programming and give numerical results. With similar models and optimal control approaches, it is possible to predict steering angles on given routes in the same context; we also briefly discuss this task.

Last, we shortly cover the area of autonomous and (partially) automated driving scenarios. Here, dynamic vehicle models linked with optimal control methods and possibly model predictive control strategies may be used for vehicle control or driver assistance systems in certain traffic scenarios.

Alle Interessierten sind dazu herzlich eingeladen.