Seminar

24. Juni 2010 15:30h HS 44-465

Technische Universität Kaiserslautern

zu folgendem Vortrag wird herzlich eingeladen:

Sliding Mode (SM) and State Dependent Riccati Equation (SDRE) Based Control Techniques for Nonlinear Systems

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Sliding Mode Control (SMC) for Linear Time Invariant (LTI) systems has been studied in details in many research works and applied to some physical systems. The control strategy developed for LTI systems is based on forcing the system trajectories onto a predefined manifold on which the system exhibits stable behavior. This manifold is, so-called sliding surface, a linear hyper surface and may be determined by utilizing the optimal control approaches such as Linear Quadratic Regulators (LQR). The sliding surface design methodology used for LTI systems may not always be extended to general nonlinear systems because of the difficulty in finding suitable (possibly) nonlinear surfaces. There are some new approaches to the sliding surface design problem for nonlinear systems some of which are nonlinear sliding surfaces created from stable manifold of the system, a sequence of linear time varying (LTV) sliding surfaces, and State Dependent Riccati Equation (SDRE) based sub-optimal sliding surfaces. Nevertheless, sliding surface design for nonlinear systems is still an active research field as there is no such a systematic SMC procedure for nonlinear systems.

Since the mid-90s, State-Dependent Riccati Equation (SDRE) strategies have emerged as general design methods that provide a systematic and effective means of designing nonlinear controllers, observers, and filters. These methods avoid directly solving a Hamilton-Jacobi-Bellman partial differential equation (PDE) or a nonlinear two-point boundary value problem (TPBVP), and yield attractive stability, optimality, robustness and computational properties that have been highly effective in a variety of practical and meaningful applications in very diverse fields of study. These include missiles, aircraft, satellite/spacecraft, Unmanned Aerial Vehicles, ship control systems, Autonomous Underwater Vehicles, automotive systems, biomedical systems, process control, and robotics, along with various benchmark problems, as well as nonlinear systems exhibiting several interesting phenomena such as parasitic, nonminimum-phase, time-delay and chaotic behavior.

The present research reviews the theory on SMC and SDRE nonlinear regulation, and discusses issues that are still open for investigation. The application, computational advantage and validity of the developed theories are illustrated on several pedagogical and realistic examples to fill the gap between theory and practice.

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