Robust Optimal Feedback for Optimal Control Problems under Uncertainties

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Abstract: Real systems and processes from the engineering, biology or economics can often be described in terms of mathematical models. These models include almost always systematic errors, like statistical uncertainties of the state and parameter estimates, model plant mismatch or discretization errors that are provided by simulation methods. Optimal solutions can be very sensitive to such errors. Furthermore, the realization of optimal scenarios including controls, initial values, design parameters in a concrete process is often very imprecise. Ignoring such uncertainties can render the mathematical results useless. Therefore, application of mathematical optimization to real-life processes demands taking into account uncertainties in the process.

This may lead on the one hand to feedback controls, when the nominal optimal control is updated as soon as actual state and parameter estimates are available, and on the other hand to robust optimization, e.g., to "worst-case" optimization, where we are looking for an optimal solution which is "good" for all possible realizations of uncertain parameters. We are interested in combination of both approaches and in computation of worst-case feedback optimal controls. Such problems have a very high degree of computational complexity, and their solution is often too expensive or slow for complex optimization problems, especially optimal control in real-time. Our aim is the development of quick approximate methods and their efficient implementation.

In this talk efficient combination of approximative robust optimization methods and feedback control and their application on linear-quadratic control problems will be presented.

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