講演会のご案内

場所：上智大学 L-821室　　日付： 2016年11月15日

Optimal control for automotive engine applications

- 講師：Benjamin Pla CMT-Motores Termicos, Universitat Politecnica de Valencia
- 時間：午後 1:15-2:05
- Summary: This lecture addresses the application of Optimal Control techniques to different control and design problems in automotive engineering, with special focus on engine related issues. To this aim, in the first part of the lecture a general Optimal Control Problem (OCP) is mathematically formulated and the main optimisation tools (Hamilton-Jacobi-Bellman, Indirect methods and Direct methods) are briefly introduced and discussed. Then, different applications of the previous techniques to powertrain control, design and assessment are presented. The cases addressed in the lecture are:

1. Optimal powertrain control of a Hybrid Electric Vehicle (HEV) under driving cycle uncertainty: There is an extensive literature addressing the problem of optimal energy management in HEVs for predefined driving cycles. This example takes into account that the driving cycle is not a priori known to obtain a near-optimal solution. The proposed method is based on analysing the power demands in a given receding horizon to estimate future driving conditions and minimise the fuel consumption while cancelling the expected battery energy consumption after a defined time horizon.
2. Optimal control of diesel engines (air-path and injection control): In this example, a Mean Value Engine Model (MVEM) is used to obtain the optimal trajectories of the EGR valve, VGT and start of injection (SOI) that minimise the fuel consumption of a Diesel engine with different NO x constraints in a predefined driving cycle. The results are experimentally validated in an engine test bench. The main issues of the application of OC are that, on one hand, the driving cycle should be a priori known; on the other hand, the result of OC is a control action sequence instead of a calibration. To deal with those issues, the second part of this example presents a model-based approach for continuously adapting the engine calibration to the traffic and changing pollutant emission limits with an OC basis.
3. Other applications: The end of the lecture is aimed to briefly present other applications of OC. In particular, the following problems will be introduced:
   - Eco-Driving: provide the sequence of driver actuation to minimise the fuel consumption in a given trip.
   - Optimal heat release (HR) shaping: evaluate the optimal evolution of the HR law in order to provide a basis for comparison of the engine performance and provide a target HR to define injection strategies and evaluate the systems or processes with room for improvement. Previous cases are extracted from publications from the control group of CMT-Motores T rmicos and follow a practical approach rather than a fundamental approach. The objective of the lecture is to show the capabilities of OC to address engineering problems dealing with the optimisation of dynamic systems.

Data based modeling and control of transient emissions in Diesel engines

- 講師：Harald Waschl Institute for Design and Control of Mechatronical Systems, Johannes Kepler University Linz
- 時間：午後 2:10-3:00
- Summary: In this talk different aspects of modeling and model based control of a passenger car Diesel engine will be covered. A main focus will be on NOx and soot emissions during transient maneuvers and real driving cycles. First, a brief overview of different data based approaches for virtual sensors for emissions and models of the engine itself will be presented. In this context an important aspect of transient emission modeling and control, namely the choice of input candidates for modeling and similar intermediate quantities for feedback control will be discussed. As control application example, an MPC approach for air system control utilizing these models will be presented. Finally, a strategy to modify the injection profile to reduce emission peaks during transients will be discussed. In all cases, examples obtained during experiments on an engine testbench with a passenger car Diesel engine will be shown to provide additional insights on implementation and effects encountered on the real system.

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