AIChE Webinar Series

Computing & Systems Technology Division (CAST) Welcomes

Erdal Aydin

Max Planck Institute for Dynamics of Complex Technical Systems

PSE Department

MAX-PLANCK-GESELLSCHAFT

Tailored Indirect Algorithms for Efficient On-line Optimization

The trend toward high-quality, low-volume and high-added value production has put more emphasis on batch and semi-batch processing due to its increased flexibility of operations. Nonlinear model predictive control (NMPC) is an important tool for the real-time optimization of batch and semi-batch processes under uncertainty. However, the fact that the transient behaviour as well as the flexibility decrease with respect to time leads to very challenging optimization problems. The preferred strategy to solve constrained nonlinear dynamic optimization problems associated with the NMPC for these processes is usually to use a so-called direct method. Nevertheless, based on the problem type at hand and the solution algorithm used, direct methods may lead to computational complexity. In particular, the large prediction horizons required in the NMPC of batch and semi-batch processes increase the real-time computational effort because of expensive matrix factorizations in the solution steps, especially at the beginning of the batch. Alternatively, indirect methods based on Pontryagin's Minimum Principle (PMP) could efficiently deal with the optimization of batch and semi-batch processes. In fact, the interplay between states and co-states in the context of PMP might turn out to be computationally quite efficient. It has been extensively argued that indirect methods are usually non-convergent and inefficient for constrained problems. In this talk, we demonstrate how indirect solution techniques can be tailored to be convergent and effective for the dynamic optimization and NMPC for batch and semi-batch processes.

Biography:

Erdal Aydin is a scientific employee/doktorand at the Max Planck Institute for Dynamics of Complex Technical Systems. In his Ph.D time, Erdal is supervised by Prof. Kai Sundmacher and Prof. Dominique Bonvin from EPFL. He holds a BS diploma in Chemical Engineering from METU and an MS diploma in Chemical and Biological Engineering from Koc University. His research interests are in the areas of nonlinear dynamic optimization, model-based control, process optimization, real-time optimization and numerical methods.

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