ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to a Guest Lecture

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"Distributed Optimization Methods for Coupled Energy Systems"

N.2.35 Thursday, 20 July 2023 11:00 a.m.

Abstract

Efficient control of energy systems is an important factor in achieving the EU's emission goals. District heating (DH) networks are an especially relevant example of such energy systems. State-of-the-art control of small and medium-sized DH networks, however, still mainly relies on simple rule-based control concepts. Handling future challenges such as varying prices and intermittent renewable production is difficult to achieve with such control concepts. Optimization-based energy management systems (EMS) are a promising high-level control approach for the efficient operation of DH networks and complex energy systems in general.

In this talk, an especially interesting control challenge is considered. When DH networks grow, often the opportunity arises to interconnect them. Since coupled energy systems are typically only very loosely coupled, a distributed optimization approach can be applied. However, if they are operated by different owners, the control task becomes challenging, especially for optimization-based approaches. This is because, in the overall objective function, the cost and revenue for any exchange of energy would cancel out and hence would not influence the operation strategy at all. In the hybrid

case, i.e. where there are more networks than owners, a hybrid of distributed optimization and game theoretic perspective has to be considered. In this talk, an augmented Lagrangian method-based algorithm is proposed to handle this hybrid case, and serve as the basis for optimization-based control of coupled energy systems.
The presented concepts were tested within the project ThermaFLEX, https://thermaflex.greenenergylab.at/, on the real-world example of the three DH networks of Leibnitz, Austria. The three DH networks are operated by two owners. Where the two networks that are operated by the same owner are directly hydraulically connected, and the third one is connected via a bidirectional heat transfer station. The goal was to reduce the overall cost and CO_2 emissions of the energy system.

Angelika Wiegele and the Department of Mathematics look forward to seeing you at the talk!