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Distributed, economic and zone model predictive control

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Abstract:

Distributed MPC is one of the topics that have attracted significant research attention in recent years. In distributed MPC, an array of distinct (local) MPC controllers carry out their calculations in separate processors and they communicate and exchange information to efficiently cooperate their actions in achieving closed-loop plant objectives. It has been recognized as one very promising next generation advanced control technique that plays an important role in smart manufacturing or Industry 4.0. Our results on distributed nonlinear MPC and coordinated MPC will be discussed. One integral component of distributed control is distributed state estimation. State estimation reconstructs the state of a system based on a model of the system and measurements of the inputs and outputs. For nonlinear systems, the state estimation problem is challenging. Our results on distributed state estimation that may be used in distributed output feedback control will be covered.

Economic MPC optimizes a general economic cost function which in general is not quadratic. It has been shown that EMPC may lead to time-varying process operation instead of steady-state operation. I will introduce a very computationally efficient EMPC design developed in my group. A general zone MPC framework will be introduced. The applications of economic MPC and zone MPC to the optimal operation of oil sand separation vessels, waste water treatment processes, anemia management in chronic renal disease and water conservation in irrigation will be discussed.

Biography:

Jinfeng Liu received the B.S. and M.S. degrees in Control Science and Engineering in 2003 and 2006, respectively, both from Zhejiang University, and the Ph.D. degree in Chemical Engineering from the University of California, Los Angeles in 2011. Since 2012 he has been with the University of Alberta, where he is currently an Assistant Professor in the Department of Chemical and Materials Engineering. His research interests are in the general areas of process control theory and practice with emphasis on model predictive control, networked and distributed state estimation and control, and fault-tolerant process control and their applications to chemical processes, wastewater treatment plants, water conservation in irrigation and anemia management. He has co-authored three books and more than 100 journal and conference publications. A more detailed description of his research interests and a list of his publications can be found at http://www.ualberta.ca/~jinfeng/index.html