UCF | Electrical and Computer Engineering

Fall 2016 Seminar Series

A Passivity-Based Perspective for Distributed Optimization

FRIDAY DECEMBER 16, 2016

3:00 PM – HEC 438

In this talk, we present passivity-based perspectives for distributed optimization. In the former half, we address a class of distributed optimization problems, and design a distributed algorithm based on so-called PI consensus algorithm. The dynamical system is then shown to be regarded as a feedback interconnection of passive systems and hence to preserve passivity. As a benefit of the passivity-based perspective, we then integrate inter-agent communication delays using passivity-based output synchronization techniques together with so-called scattering transformation. The presented solutions are then applied to a 3D human localization problem for a camera network and demonstrate their effectiveness.

In the later half, we address HVAC (Heating, Ventilation and Air Conditioning) system optimization and control for buildings, and present an integrated design procedure of optimization and physical dynamics. After formulating a building thermal dynamics and an associated optimization problem, we design an optimization dynamics based on so-called primal-dual algorithm, and prove its passivity. We then design a local controller to control physical dynamics, and prove its passivity. Based on these passivity results, we interconnect the optimization and physical dynamics, and prove convergence of the room temperatures to the optimal ones. We then consider the case with multiple buildings, and present a three-layer distributed optimal control architecture.

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Takeshi Hatanaka received the Ph.D. degree in applied mathematics and physics from Kyoto University, in 2007. Since 2007, he has been with Tokyo Institute of Technology, where he is currently an associate professor. His research interests include networked robotics and energy management systems. He is the coauthor of "Passivity-Based Control and Estimation in Networked Robotics" (Springer, 2015). He received 2014 Outstanding Research Award and 2009, 2015 Outstanding Paper Award from SICE, and 10th Asian Control Conference Best Paper Prize Award. He is a member of the Conference Editorial Board of IEEE CSS and is appointed to an AE of IEEE Transactions on Control Systems Technology.

Hosted by: Dr. Zhihua Qu