

Distributed Control in Cyber-Physical Energy Networks and Formation Systems

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Abstract

This talk is composed of three parts. The first part presents a framework considering decentralized energy coordination and generation, and flow control for supply-demand balance in distributed cyber-physical networks. Consensus-like schemes using only relative information are employed to produce energy coordination, generation, and flow control signals. For the supply-demand balance, it is required to determine the amount of energy needed at each distributed resource. Also, due to the different generation capacities of each energy resource, coordination of energy flows among distributed energy resources is essentially required. The second part introduces a decentralized formation control via orientation alignment and position estimation. In this approach, it is assumed that the agents measure the relative positions of their neighbors with respect to their own local reference frames, the orientations of which are not aligned initially. We then propose a formation control strategy consisting of an orientation alignment, a position estimation, and a position control law. We show that the proposed control strategy allows the agents to achieve the desired formation if some specified conditions are satisfied. The last part of this talk presents real experimental results using quadcopters. Mainly, we present three experimental results for a rendezvous between two quadcopters, for a cultural performance show with more than 10 quadcopters, and for a distributed formation flying.

Biography

Brief Biography

Hyo-Sung Ahn received the B.S. and M.S. degrees in astronomy from Yonsei University, Seoul, Korea, in 1998 and 2000, respectively, the M.S. degree in electrical engineering from the University of North Dakota, Grand Forks, in 2003, and the Ph.D. degree in electrical engineering from Utah State University, Logan, in 2006. Since July 2007, he has been with the School of Mechatronics, Gwangju Institute of Science and Technology (GIST), Gwangju, Korea. He is currently Professor. Before joining GIST, he was a research engineer at Korea Aerospace Industries (KAI), Daejeon, Korea, from 2000 to 2001 and a senior researcher at the Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea from 2006 to 2007. He is the author of the research monograph *Iterative Learning Control: Robustness and Monotonic Convergence for Interval Systems* (Springer-Verlag, 2007). His research interests include distributed control, learning control, network localization, and autonomous navigation systems. He is the winner of the 2014 Knowledge Creation Grand Prize awarded by MSIP (Ministry of Science, ICT and Future Planning, Korea) and KISTI (Korea Institute of Science and Technology Information).