

## Keynote Lecture II

### Optimal Design for Cooperative Control Synchronization and Games on Communication Graphs

Frank L. Lewis

The University of Texas at Arlington, USA

---

#### Abstract

In this talk we present design methods for cooperative controllers for distributed systems. The developments are for general directed graph communication structures, for both continuous-time and discrete-time agent dynamics. Our objective is to provide local agent feedback design methods that are independent of the graph topology and so function on a wide range of graph structures. An optimal design method for local feedback controllers is given that decouples the control design from the graph structural properties. A theory of duality between controllers and observers on communication graphs is given, including methods for cooperative output feedback control based on cooperative regulator designs.

In Part 2 of the talk, we discuss graphical games. Standard definitions of Nash equilibrium are not useful for graphical games since, though in Nash equilibrium, all agents may not achieve synchronization. A strengthened definition of Interactive Nash equilibrium is given that guarantees that all agents are participants in the same game, and that all agents achieve synchronization while optimizing their own value functions.

---

#### Biography



Frank L. Lewis, Fellow IEEE, Fellow IFAC, Fellow U.K. Institute of Measurement & Control, PE Texas, U.K. Chartered Engineer, is Distinguished Scholar Professor, Distinguished Teaching Professor, and Moncrief-O'Donnell Chair at The University of Texas at Arlington Research Institute. IEEE Control Systems Society Distinguished Lecturer. He obtained the Bachelor's Degree in Physics/EE and the MSEE at Rice University, the MS in Aeronautical Engineering from Univ. W. Florida, and the Ph.D. at Ga. Tech. He works in feedback control, intelligent systems, distributed control systems, and sensor networks. He is author of 6 U.S. patents, 250 journal papers, 360 conference papers, 15 books, 44 chapters, and 11 journal special issues. He received the Fulbright Research Award, NSF Research Initiation Grant, ASEE Terman Award, Int. Neural Network Soc. Gabor Award 2009, U.K. Inst Measurement & Control Honeywell Field Engineering Medal 2009. Received IEEE Computational Intelligence Society Neural Networks Pioneer Award 2012. Received Outstanding Service Award from Dallas IEEE Section, selected as Engineer of the Year by Ft. Worth IEEE Section. Listed in Ft. Worth Business Press Top 200 Leaders in Manufacturing. Received the 2010 IEEE Region 5 Outstanding Engineering Educator Award and the 2010 UTA Graduate Dean's Excellence in Doctoral Mentoring Award. Elected to UTA Academy of Distinguished Teachers 2012. He served on the NAE Committee on Space Station in 1995. He is an elected Guest Consulting Professor at South China University of Technology and Shanghai Jiao Tong University. Founding Member of the Board of Governors of the Mediterranean Control Association. Helped win the IEEE Control Systems Society Best Chapter Award (as Founding Chairman of DFW Chapter), the National Sigma Xi Award for Outstanding Chapter (as President of UTA Chapter), and the US SBA Tibbets Award in 1996 (as Director of ARRI's SBIR Program).