Abstract

“Paracontractions” are nonlinear maps which are applicable to certain optimization and estimation problems and to various types of numerical calculations. In this talk a distributed algorithm is described for finding a common fixed point of a family of m paracontractions assuming that such a common fixed point exists. The common fixed point is simultaneously computed by m agents assuming each agent knows only paracontraction, the current estimates of the fixed point generated by its neighbors, and nothing more. Each agent recursively updates its estimate of the fixed point by utilizing the current estimates generated by each of its neighbors. Neighbor relations are characterized by a time-dependent directed graph whose vertices correspond to agents and whose arcs depict neighbor relations. It is shown that for any family of paracontractions which has at least one common fixed point, and any sequence of strongly connected neighbor graphs, the algorithm causes all agent estimates to converge to a common fixed point. Generalizations of this result are also discussed. For example, if the paracontractions are affine linear functions, necessary and sufficient conditions for exponential convergence are obtained.

Bio

A. Stephen Morse was born in Mt. Vernon, New York. He received a BSEE degree from Cornell University, MS degree from the University of Arizona, and a Ph.D. degree from Purdue University. He was associated with the Office of Control Theory and Application (OCTA) at the NASA Electronics Research Center in Cambridge, Massachusetts. Since leaving NASA he has been with Yale University where he is presently the Dudley Professor of Engineering. His main interest is in system theory and he has done research in network synthesis, optimal control, multivariable control, adaptive control, urban transportation, vision-based control, hybrid and nonlinear systems, sensor networks, and coordination and control of large grouping of mobile autonomous agents. He is a Fellow of the IEEE, a Fellow of the International Federation of Automatic Control (IFAC), a past Distinguished Lecturer of the IEEE Control System Society, and a co-recipient of the Society’s 1993 and 2005 George S. Axelby Outstanding Paper Awards. He has twice received the American Automatic Control Council’s Best Paper Award and is a co-recipient of the Automatica Theory/Methodology Prize. He is the 1999 recipient of the IEEE Technical Field Award for Control Systems. He is the 2013 recipient of the American Automatic Control Council’s Richard E. Bellman Control Heritage Award. He is a member of the National Academy of Engineering and the Connecticut Academy of Science and Engineering.