

The Continuing Legacy of Roger W. Brockett

Preface to the Special Issues



This is the first of four special issues dedicated to Professor Roger W. Brockett, a pioneering researcher and educator, in the field of Systems, Control and Communication.

Roger W. Brockett received the Ph.D. degree from Case Institute of Technology in 1964. From 1963 to 1967 he was an Assistant Professor of Electrical Engineering at MIT, and from 1967 to 1969 he was an Associate Professor of Electrical Engineering. Since 1969 he has been on the faculty of Harvard University, first as Gordon McKay Professor of Applied Mathematics in the Division of Engineering and Applied Physics, and, since 1989 as An Wang Professor of Electrical Engineering and Computer Science. He has held a number of visiting positions all over the world, including Warwick

University, Imperial College, University of Rome, Washington University, University of Groningen, University of Florida, University of Nagoya, Australian National University, Ben Gurion University, University of Bremen, and Tokyo Institute of Technology.

Roger Brockett has made leading contributions to a wide range of subjects including:

1. stability of nonlinear feedback systems;
2. geometric control theory;
3. stochastic systems and nonlinear filtering;
4. applications of Lie theory to nonlinear systems and control;
5. robotics;
6. formal languages for motion description;
7. computer vision;
8. geodesic and gradient flows on manifolds;
9. information based control and specification complexity;
10. minimum attention control and quantum control.

In recognition of these and other contributions, he has received awards including: the Donald P. Eckman award (1967) and the Richard E. Bellman Control Heritage award (1989) from the American Automatic Control Council, the IEEE Control Systems Science and Engineering award (1991), the W.T. and Idalia Reid prize from SIAM (1996), the Rufus Oldenburger medal from ASME (2005), and elected membership in the U.S. National Academy of Engineering (1991). Most recently, he has been selected to receive the IEEE Leon Kirchmayer Graduate Education Award for 2009, for his extensive contributions as a teacher in the classroom, as an expositor of fundamental ideas in system science and engineering, and as the thesis advisor for more than sixty Ph.D. students, many of whom have gone onto distinguished careers

of their own.

In the course of an illustrious career, Roger Brockett has also served the fields of science and engineering through his participation on editorial boards (IEEE Transactions on Automatic Control, SIAM Journal on Mathematical Analysis, SIAM Journal on Control and Optimization, Nonlinear Analysis, Information and Control, Systems and Control Letters, and IEEE Transactions on Robotics and Automation), and advisory panels of the National Research Council of the U.S. National Academies.

During the course of 2008, the year of Brockett's 70-th birthday, several celebratory projects were undertaken, including a one-day workshop at the 47-th IEEE Conference on Decision and Control focused on the current state of several research areas to which he made widely recognized contributions. A photographic record may be found at <http://www.ieeecss.org/CAB/conferences/cdc2008/BrockettWorkshop.html>. In early 2008, the Editors of Communications in Information and Systems (CIS) invited a small group of former students and colleagues to guest edit special issue dealing with Brockett's work. This and the next several issues of CIS are the results. When the Guest Editors sought Roger Brockett's views on this occasion, he shared the following observation on scientific communication:

"Most would agree that technicalities should not be allowed to dominate or block progress, but also they should not be ignored. Raul Bott¹ [who was Brockett's long-time colleague at Harvard] once said that certain well known contributors to topology wrote "morally correct" theorems, apparently feeling that it was better to withhold the word proof in some cases. It seems to be in the nature of most applied work that the authors, through ignorance or not wishing to discourage casual readers, steer an intermediate course between complete rigor and bold intuition. There certainly would be a prize for the most successful navigation of the waters populated by stark rigor on one hand and blithe disregard for anything but intuition on the other, if only there were a jury that could agree on a definition of what was meant by "successful". People deal with this situation in a variety of ways and this collection also speaks to this diversity."

Response to the call of papers was enthusiastic and twenty three papers were finally accepted for publication after a careful review process. Due to page constraints, these papers are published in four consecutive issues, grouped around four majors themes: Nonlinear Control Theory, Stochastic Systems, Geometric Control Theory, and Information Based Control and Quantum Control. These correspond to some of the key areas in which Roger Brockett has boldly navigated the uncharted waters and helped guide fellow researchers in their own journeys of discovery.

— The Board of Guest Editors: John Baillieul, John S. Baras, Anthony Bloch, P.S. Krishnaprasad, and Jan C. Willems, and CIS co-editors-in-chief: Wing-Shing Wong and Stephen S.-T. Yau

¹Raoul Bott , "Morse theory indomitable," Publications mathematiques de l'I.H.E.S, tome 68 (1988), pp 99-114.