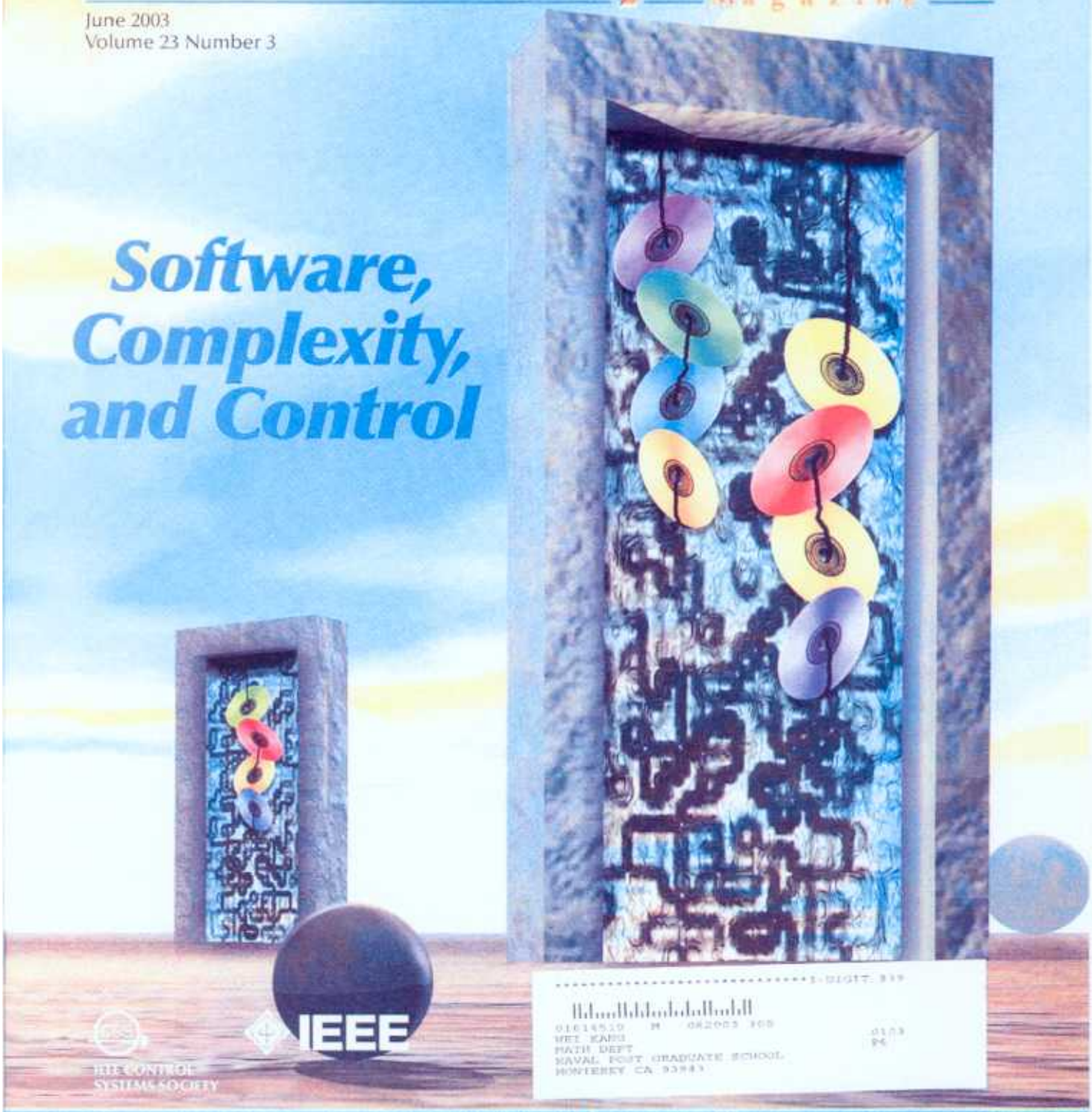
IEEE
Control Systems
Magazine

June 2003
Volume 23 Number 3



Software, Complexity, and Control

Symposium on New Trends in Nonlinear Dynamics and Control and Their Applications

The Symposium on New Trends in Nonlinear Dynamics and Control and Their Applications was held 18-19 October 2002 at the Naval Postgraduate School (NPS) in Monterey, California. The symposium was organized in conjunction with the 60th birthday of Prof. Arthur J. Krener, a pioneer in nonlinear control theory and its applications for the last three decades. The symposium provided a wonderful opportunity for control theorists to review major developments in nonlinear control theory from the past, to discuss new research trends for the future, to meet with old friends, and to share the success and experience of the community with many young researchers who are just entering the field. The symposium was funded by NSF, AFOSR, NPS, and Southern Illinois University (SIU).

(left to right) A.J. Krener, R. Brockett, and P.S. Krishnaprasad.

The symposium got off to an excellent start with an opening lecture by Prof. Krener, who gave an excellent survey of the minimum energy estimator, introduced in 1968 and refined in 1980. He closed his talk with a brand-new result on the global convergence of the extended Kalman filter under broad and verifiable hypotheses.

The remainder of the conference was organized into five sessions, each beginning with a featured speaker, all of whom held to the same high standard set in the opening lecture. Alberto Isidori addressed a new problem on the adaptation of internal models to exogenous inputs. The presentation clearly demonstrated the potential of a new design methodology, in which a model of all expected exogenous inputs is embedded into the controller and the parameters of these models are continuously adapted. Witold Respondek spoke about the symmetries of nonlinearizable single-input systems. A rather surprising result, proved using the canonical form, was that such systems admit at most two one-parameter families of symmetries. Roger Brockett spoke on quantum control with applications to quantum computing.

After a brief review of earlier results on tracking performance posed by unstable zero dynamics, Petar Kokotovic presented examples of a method of dynamic compensation that alleviates the effects of stable unmodeled dynamics with unstable zeros in feedback stabilization problems. Chris Byrnes opened his talk with an exposition of some lesser known results in the Poincaré-Bendixson theory and some higher dimensional analogs developed by G.D. Birkhoff. He then presented some existence results for periodic responses to periodic forcing for signals with arbitrary amplitude in arbitrary dimension.

(left to right) W. Lin, W. Kang, A.J. Krener, C.I. Byrnes, T.J. Tarn, A. Isidori, and Mrs. Isidori.

The five sessions contained an additional 25 invited presentations showcasing the leading edge in nonlinear dynamics and control from around the world. Lively discussions and debates were the norm, and these generally continued in the lobby of the lecture hall during the breaks.

A panel discussion on future directions of nonlinear dynamics and control was held at midday on 19 October. The

panel, chaired by Richard Murray, consisted of Chris Byrnes, Petar Kokotovic, David Mayne, and A. Stephen Morse. Each panel member gave a brief outline of their thoughts on new trends in the development of nonlinear control. A lively open discussion between the panelists and audience followed. The general consensus of the panelists was that this is an exciting and critical moment in the development of nonlinear control theory. There are increasing demands on the development of nonlinear control theory to enable engineers and scientists to deal with the complexity of various problems, such as the design of highly interconnected systems, robust control of networks, and management of unmanned vehicles for missions. It was noteworthy that the panelists also discussed the importance of numerous problems from biology and medical sciences that will surely yield fruitful directions for future research in nonlinear dynamics and control.

A conference banquet was held on the evening of 18 October to celebrate the 60th birthday of the symposium's guest of honor, Arthur J. Krener, and his fundamental contributions in many critical areas of nonlinear dynamics and control theory. The highlight of the evening was a phenomenal presentation by Chris Byrnes on the life and times of a man he very succinctly described as "a great researcher, teacher, and friend."

—Wei Kang
—Carlos Borges
—Mingqing Xiao