5 AACC AWARDS FOR 2002

Every year the American Automatic Control Council makes a series of awards to recognize important contributions to the field. This year, the roster of award winners includes the Richard Bellman Heritage Award – Petar Kokotovic, the Donald P. Eckman Award – Ilya Kolmanovsky, the John R. Ragazzini Award – Robert F. Stengel, the Control Engineering Practice Award – Dagfinn Gangsaa, and two O. Hugo Schuck Best Paper Awards. These contributions will be recognized at the Awards Banquet on Thursday, May 9 in the Hilton Anchorage, 11:30 a.m. - 1:15 p.m.

5.1 Richard Bellman Heritage Award – Petar Kokotovic

The Richard E. Bellman Control Heritage Award is given for distinguished career contributions to the theory or application of automatic control. It is the highest recognition of professional achievement for US control systems engineers and scientists. The recipient must have spent a significant part of his/her career in the USA.

Citation: For pioneering contributions to control theory and engineering, and for inspirational leadership as mentor, advisor, and lecturer over a period spanning four decades.

Petar V. Kokotovic received graduate degrees in 1962 from the University of Belgrade, Yugoslavia, and in 1965 at the Institute of Automation and Remote Control, USSR Academy of Sciences, Moscow. During his studies he worked for two six month periods: in 1956, at Electricité de France, Paris, and then in 1957, at AEG, Stuttgart, Germany. From 1959 until 1966, he was with the Pupin Research Institute in Belgrade, Yugoslavia. From 1966 until 1990 he was with the Department of Electrical and Computer Engineering and the Coordinated Science Laboratory at the University of Illinois, Urbana, where he held the endowed Grainger Chair. In 1991 he joined the Electrical and Computer Engineering Department of the University of California at Santa Barbara, where he is currently the Director of the Center for Control Engineering and Computation.
In the 1960’s, Kokotovic developed the sensitivity points method, a precursor to adaptive control, still in use for automatic tuning of industrial controllers. In the 1970’s, he pioneered singular perturbation techniques for multi-time-scale design of control systems and flight trajectories, which found widespread applications. One of them was a coherency-aggregation methodology for large scale Markov chains and power systems. In the 1980’s, Kokotovic and coworkers identified the main forms of adaptive systems instability and introduced redesigns that made adaptive controllers more robust. Kokotovic’s current research is in nonlinear control, both robust and adaptive. He initiated the development of a popular nonlinear recursive design-backstepping, and its use for robust and adaptive nonlinear control. As a long-term industrial consultant, Kokotovic contributed to the design of computer controls for car engines and automotive systems at Ford, and to power system stability analysis at General Electric. Recently, he led a five-year collaborative research (with United Technologies) on nonlinear control of axial compressors for jet engines.

Professor Kokotovic supervised some 30 Ph.D. students and 20 postdoctoral researchers. With them he co-authored numerous papers and ten books, four of which appeared in 1995-96. Professor Kokotovic is a fellow of the IEEE and a member of the U.S. National Academy of Engineering. He is the recipient of the two highest control engineering awards: 1990 Quazza Medal by the International Federation of Automatic Control, and the 1995 Control Systems Field Award by the IEEE. He also received an Eminent Faculty Award, two Outstanding IEEE Transactions Paper Awards (1983 and 1993), and delivered the 1991 IEEE Control Systems Society Bode Prize Lecture. His most recent recognition is the 2002 IEEE James H. Mulligan Jr. Education Medal.

5.2 Donald P. Eckman Award – Ilya Kolmanovsky

The Donald P. Eckman Award recognizes an outstanding young engineer in the field of automatic control. The recipient must be younger than 35 years at the time of the award. Contributions may be technical or scientific publications, theses, patents, inventions, or combinations of the above in the field of automatic control made while the nominee was a resident of the USA.

Citation: For contributions to nonlinear control and for pioneering work in automotive engine control of powertrain systems.

Ilya Kolmanovsky has studied as an undergraduate at Moscow Aviation Institute in Russia. He received his M.S. and Ph.D. degrees in Aerospace Engineering in 1993 and 1995, respectively, and his M.A. in Mathematics in 1995, all from the University of Michigan, Ann Arbor. In 1996 Dr. Kolmanovsky joined Ford Research Laboratory of Ford Motor
Company in Dearborn, Michigan as a Technical Specialist. At Ford he has been conducting research on control, modeling and systems development of advanced technology automotive gasoline and diesel powertrains, and is presently a Staff Technical Specialist. Dr. Kolmanovsky has also made contributions to nonlinear control of non-holonomic systems with applications to multi-body spacecraft, nonlinear control of systems with pointwise-in-time state and control constraints, control of systems with complex dynamics, including switching systems, stochastic systems, systems with delays and systems described by partial differential equations.

Dr. Kolmanovsky has published over a hundred conference and journal articles in the areas of control and automotive systems technology. He holds nineteen U.S. patents. Dr. Kolmanovsky has served in the past as an Associate Editor of IEEE Control Systems Society Conference Editorial Board and was a program committee member of two American Control Conferences. He is presently serving as an Associate Editor of IEEE Transactions on Control Systems Technology.

5.3 John R. Ragazzini Award – Robert F. Stengel

The John R. Ragazzini Award is given to recognize outstanding contributions to automatic control education in any form. These contributions can be from any source and in any media, i.e., electronic, publications, courses, etc.

Citation: For outstanding ability to motivate and educate undergraduate and graduate students in optimal control, estimation, and flight mechanics.

Robert Stengel is Professor and former Associate Dean of Engineering and Applied Science at Princeton University. Prior to his 1977 Princeton appointment, he was with The Analytic Sciences Corporation, Charles Stark Draper Laboratory, U.S. Air Force, and National Aeronautics and Space Administration. A principal designer of the Project Apollo Lunar Module manual attitude control logic, he also contributed to the design of the Space Shuttle guidance and control system. From 1977 to 1983, he was Director of Princeton’s Flight Research Laboratory, where he investigated aircraft flying qualities, digital control, and system identification using two variable-stability, fly-by-wire aircraft. Current research interests include bioinformatics, nonlinear, robust, and adaptive control systems, dynamics of aerospace vehicles, optimization, and intelligent systems.

Dr. Stengel received degrees from M.I.T. (Aeronautics & Astronautics, S.B., 1960) and Princeton University (Aerospace and Mechanical Sciences, M.S.E., M.A., Ph.D., 1965, 1966, 1968). He is a Fellow of the IEEE and a Fellow of the AIAA. He received the AIAA Mechanics and Control of Flight Award (2000) and is a recipient of the FAA’s
first annual Excellence in Aviation Award (1997). He was Associate Editor at Large of the IEEE Transactions on Automatic Control, Vice Chairman of the Congressional Aeronautical Advisory Committee, and Chairman of the AACC Awards Committee. He has served on numerous governmental advisory committees. He has been a member of the Program Council for the New Jersey Space Grant Consortium and of the National Research Council Committee on Naval Capabilities for Theater Missile Defense.

Dr. Stengel directs the Laboratory for Control and Automation and the undergraduate Program in Robotics and Intelligent Systems at Princeton. He has taught courses on robotics and intelligent systems, control and estimation, aircraft flight dynamics, and space flight (the freshman seminar, From the Earth to the Moon). Dr. Stengel wrote the book, *Optimal Control and Estimation* (Dover, 1994) and has authored or co-authored numerous technical papers and reports.

### 5.4 Control Engineering Practice Award – Dagfinn Gangsaas

The **Control Engineering Practice Award** is given to an individual or team for significant contributions to the advancement of control practice. The primary criterion for selection will be for the application and implementation of innovative control concepts, methodology, and technology, for the planning, design, manufacture, and operation of control systems. Achievement and usefulness will be evidenced by the benefit to society and by the degree of acceptance by those who use control as a tool. The work on which the nomination is based must have been performed while the nominated individual or at least one member of the team was a resident of the USA.

**Citation:** For pioneering contributions to the development and usage of highly-effective multivariable control design methods in the aerospace industry.

Dagfinn Gangsaas earned the B.Sc. degree with Honors in Aeronautical Engineering from University of Glasgow in 1967 and the M.S. degree in Aeronautics and Astronautics from University of Washington in 1974. He is currently an independent consultant in aircraft flight control.

During 31 years with the Boeing Company he held a wide range of engineering and management positions in research, development and implementation of flight control systems for commercial and military aircraft. Early in his career he worked in aircraft flight mechanics and the design and flight testing of the first digital fly-by-wire systems at Boeing (YC-14). In subsequent assignments he pioneered the successful practical application of linear quadratic synthesis techniques to several research aircraft, the Boeing 767, the Boeing Joint Strike Fighter, and the Darkstar autonomous aircraft; these techniques are currently being applied to the Embraer 170/190 family of regional jets. He conducted and directed research into highly integrated flight, propulsion and utilities control system architectures with applications of photonics technology, automated computer-aided control system design tools, flight trajectory optimization, adaptive control, flying qualities, reli-
ability and failure analysis, failure detection and redundancy management, and advanced hydro-mechanical and electrical actuation systems. He directed the early development of the integrated flight and propulsion control systems for Navy, Marine and Air Force versions of Boeing’s entry into the competition for the Joint Strike Fighter. Following the crash of the Darkstar autonomous aircraft he led the redesign of the flight control and other systems which led to the successful resumption of flight testing of this very challenging aircraft. During his last assignment with Boeing he co-chaired the joint FAA and Boeing 737 Rudder Control System Independent Investigation Board. Mr. Gangsaas has three United States patents and over 20 publications. Of particular note are: Wind Models for Flight Simulator Certification of Landing and Approach Guidance and Control Systems (adopted as a standard for atmospheric wind and turbulence simulation models); Application of Modern Synthesis to Aircraft Control: Three Case Studies (IEEE Transactions on Automatic Control, Outstanding Paper of the Year Award for 1986); and Control Law Design For Aircraft Using Multi-variable Techniques (International Journal of Control, included as a chapter in the book Advances in Aircraft Flight Control, Mark Tischler, ed., 1996).

Mr. Gangsaas has been a Visiting Fellow to the Australian National University, a past Director, Officer and President of the American Automatic Control Council, past member of the AIAA Guidance, Navigation and Control and the SAE Aerospace, Guidance and Control committees, Associate Fellow of the AIAA, General Chairman of the 1990 ACC and the 1983 AIAA GNC conferences, and past Chairman of the Boeing Inter-Division Flight Control Technology Group.

5.5 O. Hugo Shuck Best Paper Awards

The O. Hugo Schuck Awards are given to recognize the best two papers presented at the previous ACC. One award is for a paper emphasizing contributions to theory and the other emphasizing significant or innovative applications. The papers must have been presented by the awardee or a coauthor. Criteria for selection include the quality of the written and oral presentation, the technical contribution, timeliness, and practicality.

“Invariance Control of Normal Forms with Input Driven Internal Dynamics”, J. Mareczek, M. Buss and M. Spong

This paper addresses the problem of making a given state space region positively invariant while guaranteeing global exponential stability for a class of systems with reduced relative degree in normal form where the control variable appears in the internal dynamics. The linear subsystem is globally exponentially stabilized by a dissipativity approach. This allows the freedom to switch one control parameter at arbitrary times which is used to control a state space region positively invariant. This allows the freedom to switch one control parameter at arbitrary times which is used to control a state space region positively invariant. A design method for the resulting Invariance Controller and the state space region is presented and evaluated by simulations of a peaking system.
Jörg Mareczek was born in Germany in 1971. He received the Diploma degree in Electrical Engineering and Information Technology from the Technical University of Munich in May, 1997. He then joined the Institute of Automatic Control Engineering at the Technical University of Munich as a research associate where he developed the control method of Invariance Control for stabilization of a generalized class of underactuated systems. For this work he is expected to receive a Doctoral degree in April, 2002. Since December, 2001, he has been with Diehl Ltd. in Nürnberg, where he is involved in developing guidance and control algorithms for intelligent autonomous air and landcraft weapons. His research interests are in nonlinear control theory with an emphasis on geometrically oriented nonlinear switching control, robustness, Lyapunov- and passivity-based methods.

Martin Buss was born in Germany in 1965. He received the diploma engineer degree in Electrical Engineering in 1990 from the Technical University Darmstadt, Germany, and the Doctor of Engineering degree in Electrical Engineering from the University of Tokyo, Japan, in 1994. In 2000 he finished his residency in the Department of Electrical Engineering and Information Technology, Technische Universität München, Munich, Germany. In 1988 he was a research student at the Science University of Tokyo, Japan, for one year. As a postdoctoral researcher he stayed with the Department of Systems Engineering, Australian National University, Canberra, Australia, in 1994/5. From 1995-2000 he has been senior research assistant and lecturer at the Institute of Automatic Control Engineering, Department of Electrical Engineering and Information Technology, Technical University Munich, Germany. He is a member of IEEE, RSJ, and SICE societies and associate editor in the IEEE CSS conference editorial board. Currently he is full professor, head of the control systems group, and deputy director of the Institute of Energy and Automation Technology, Faculty IV – Electrical Engineering and Computer Science, Technical University Berlin, Germany. His research interests include automatic control, mechatronics, multi-modal human-system interfaces, optimization, nonlinear and hybrid discrete-continuous systems.

Mark W. Spong received the B.A. degree, magna cum laude, in mathematics and physics from Hiram College in 1975, the M.S. in mathematics from New Mexico State University in 1977, and the M.S. and D.Sc. degree in systems science and mathematics in 1979 and 1981, respectively, from Washington University in St. Louis. He was on the faculty of
Lehigh University and Cornell University prior to joining the University of Illinois at Urbana-Champaign in 1984. At Illinois he is currently Professor of General Engineering and Acting Director of the Coordinated Science Laboratory. In addition, he is Director of the College of Engineering Robotics and Automation Laboratory, which he founded in 1987 and the John Deere Mechatronics Laboratory, which he founded in 1995.

He has held visiting positions at the University of Waterloo, Canada, the CINVESTAV del IPN, Mexico City, the Lund Institute of Technology, Sweden, the Laboratoire d’Automatique de Grenoble, France, the Universite de Tecnologie de Compiegne, France, the Katholiek Universiteit, Leuven, Belgium, the National University of Singapore, and the Technical University of Munich. Dr. Spong’s main research interests are in robotics, mechatronics, and nonlinear control theory. He has published over 150 technical articles in control and robotics and is co-author of two books. Within the IEEE he served as Vice President for Publication Activities of the Control Systems Society from 2000-2002, Editor-in-Chief of the Transactions on Control Systems Technology from 1997-2000, and has been an Associate Editor for the Transactions on Automatic Control, the Transactions on Control Systems Technology and the Control Systems Magazine. He served on the Board of Governors of the Control Systems Society from 1994-2002.

Dr. Spong is a Fellow of the IEEE and a member of Phi Beta Kappa. He received the Senior Scientist Research Award from the Alexander von Humboldt Foundation, Bonn, Germany, in 1999 and the IEEE 3rd Millennium Medal in 2000. In addition, he is President of Mechatronic Systems, Inc., a company that he founded in 1996.

“Control of a Dual Stage Actuator System for Noncircular Cam Turning Process”, B-S. Kim, J. Li and T-C. Tsao

This paper presents a robust repetitive controller design for a dual stage actuator system for the noncircular cam turning process. The secondary actuator in this dual stage system is a piezoelectric actuator which is installed inside of the hollow piston of an electrohydraulic actuator. The controller is designed through a sequence of two SISO designs under the assumption that there is little interaction between two actuator systems. Experimental results show the tracking system performance improvement in noncircular cam turning applications.
Byung-Sub Kim was born in Seoul, Korea, in 1968. He received the B.E. degree from Chung-Ang University, Korea, in 1990 and the M.S. degree from Korea Advanced Institute of Science and Technology in 1992 and the Ph.D. degree from the University of Illinois at Urbana-Champaign in 2001, all in mechanical engineering. From 1992 to 1996, he was employed at SindoRicoh Co., Korea. As a junior researcher at SindoRicoh Co., he was involved in analog and digital copier development projects. He is currently a postdoctoral associate in Mechanical and Aerospace Engineering Department at the University of California, Los Angeles. His research interests include dynamic modeling and control system design for mechanical systems.

Jianwu Li received his B.S. and M.S. from Shanghai Jiao Tong University, People’s Republic of China, in 1989 and 1992 respectively, and Ph.D. from the University of Illinois at Urbana-Champaign, in 1999, all in mechanical engineering. He was an instructor at Shanghai Jiao Tong University from 1992 to 1995. Since 1999, he has been employed by Lighting Technology of General Electric Company at Cleveland, Ohio.

At GE Lighting he has built and optimized a couple of advanced special lighting machines, which represent the state of the art in the lighting manufacture industry, and has a pending patent from this work. His research involves application of advanced control theory, design and automation of manufacturing process and equipment, machine vision system and precision motion control at micron and nanometer level.

Tsu-Chin Tsao received the B.S. degree in Engineering from National Taiwan University in Taipei, Taiwan, in 1981, and M.S. and Ph.D. degrees in Mechanical Engineering from the University of California, Berkeley, in 1984 and 1988, respectively.
In August 1988, he joined the Department of Mechanical And Industrial Engineering at University of Illinois at Urbana-Champaign, where he was an assistant professor and associate professor till July of 1999. He subsequently joined the faculty of Mechanical and Aerospace Engineering Department at the University of California, Los Angeles where he is currently a professor. His research interests include modeling and control of mechanical systems, precision motion control, and mechatronics. His recognitions include “ASME Journal of Dynamic Systems, Measurement, and Control Best Paper Award” for the papers published in the journal in 1994; “Senior Xerox Award for Faculty Research” from the College of Engineering, University of Illinois at Urbana-Champaign, in 1996, in recognition of excellence in engineering research during the past five academic years; and “Outstanding Young Investigator Award” from ASME Dynamic Systems and Control Division, in 1997, in recognition of outstanding contributions in both theory and application of adaptive feedfoward and repetitive control algorithms.