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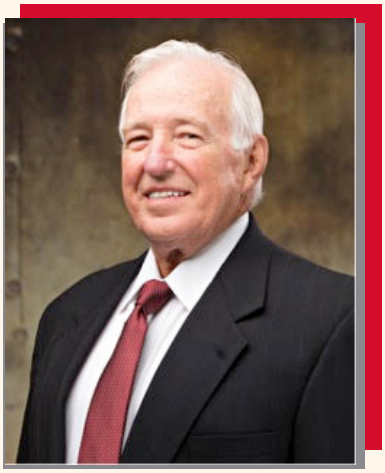
Integrating the Design of Structure, Control, and Signal Processing



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ABSTRACT:

This talk presents some steps toward the formal integration of Structure, Control, and Signal Processing designs. To integrate structure and control we employ the tensegrity structural paradigm. To integrate signal processing and control we employ our recent work on Information Architecture, where the precisions and locations of all sensors and actuators are coordinated with the control design, which are all dictated by the closed loop performance requirements, including a cost constraint on the hardware. We assume that sensor or actuator costs are proportional to the precision of the instrument. The design constraints are: i) the cost of all sensors and actuators must be less than a specified budget, $, ii) the control energy must satisfy a specified upper-bound, U, iii) the closed loop performance must satisfy a specified covariance upper-bound, Y, of the output error, iv) adjustable parameters of the structure are coordinated with the joint structure/control design to achieve the required performance bounds, Y. This feasibility problem allows one to solve several different optimization problems, simply by reducing iteratively any one of the levels sets (constraint requirements) until feasibility is lost. For example, by minimizing control energy subject to all other constraints one may find the performance bounds which require feedback control, and which do not.

BIOGRAPHY:

Dr. Robert Skelton is a TEES Distinguished Research Professor, and faculty fellow at the Texas A&M University Hagler Institute for Advanced Study. Skelton began his career at the Marshall Space Flight Center, working first with Lockheed Missiles and Space Company and then Sperry Rand for 12 years. From 1975-1996, Dr. Skelton served as a professor of aeronautics and astronautics at Purdue University. In 1996, he became director of UCSD's Structural Systems and Control Laboratory at the University of California, San Diego (UCSD). In 2006, UCSD named Dr. Skelton the Daniel L. Alspach Professor of Dynamics Systems and Controls in the Jacobs School of Engineering and professor emeritus in 2009. He now is creating an interdisciplinary systems engineering program at TAMU. He has been involved with spacecraft control (SKYLAB and Hubble Space Telescope) for many years and has served on the National Research Council's Aeronautics and Engineering Board. Dr. Skelton is a member of the NAE, a fellow of the IEEE and the IFAC, an Emeritus fellow of the AIAA, and a life member of the Alexander von Humboldt Foundation. His major awards include: the SKYLAB Achievement Award, the Japan Society for the Promotion of Science Award, the Humboldt Foundation Senior US Scientist Award, the Norman Medal from the American Society of Civil Engineers, the Humboldt Foundation Research Award, the NASA Appreciation Award, and the AIAA Mechanics and Control of Flight Award. He has published seven books and over 200 journal papers.