

Seminar Series

Choosing Information Architecture in Control and Estimation Problems

Dr. Bob Skelton

Structural Systems and Control Laboratory, Director
University of California at San Diego

Abstract

Most control and estimation theories assume that the sensors and actuators have already been selected and placed. Let the choice of sensor/actuator types, sensor/actuator locations, and sensor/actuator precisions (signal to noise ratios) be called the choice of the "Information Architecture". Furthermore, let the precision of a sensor/actuator be linearly related to the cost of the instrument. Now suppose the design objective is to require that: a) the total cost of all instruments be kept below a specified number, b) the covariance of the control signals be less than a specified matrix value, and the covariance of a selected output vector be below a specified matrix value. This talk shows that all but one of the decisions in the Information Architecture problem (sensor/actuator location) is indeed convex and is globally solved. An ad hoc algorithm is proposed to find solutions to the complete problem, including the selection of locations for the sensors/actuators. The solution of the Information Architecture problem also provides the solution to other seemingly unrelated problems, such as the optimal distribution of computational resources in a network and the problem of minimizing the computational error in digital simulations of a set of differential equations.

Biography of Speaker

Dr. Skelton, Daniel L. Alspach Professor of Dynamic Systems and Controls is currently the Director of Structural Systems and Control laboratory at the University of California San Diego. Previously, he held the same position at Purdue University. Dr. Skelton also worked in industry with Sperry Rand Corporation and Lockheed Missiles and Space Company, where he aided in the designed control systems for America's first space station SKYLAB. His PhD is in Mechanics and Structures from UCLA. He earned his undergraduate degree in Electrical Engineering from Clemson University. Dr. Skelton pioneered techniques for the integration of the disciplines of material sciences, structures and control, which have been the subject of his research for the last thirty years. He is the author of 5 books on Modeling and Control, the latest one; Tensegrity Systems, appeared June 2009. He is a Fellow of the Institute of Electrical and Electronic Engineers (IEEE). He is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA). He is a recipient of the Norman Medal from the American Society of Civil Engineers (ASCE).