Plenary Session

INNOVATION IN UNDERGRADUATE CONTROLS EDUCATION AT HOWARD UNIVERSITY

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BIOGRAPHY

AHMED RUBAAI received the M.S.E.E degree from Case Western Reserve University, Cleveland, OH, and the Dr. Eng. degreefrom Cleveland State University, Cleveland, OH, in 1983 and 1988, respectively. In 1988, he joined Howard University, Washington, DC, as a faculty member, where he ispresently a Professor and Chairperson of the Electrical Engineering and Computer Science Department.Dr. Rubaai has been named an IEEE Fellow in 2015. As a researcher, Dr. Rubaai has made significant contributionsto the development and control of electric motor drives for industrial system applications in a variety of roles including: scientist, research engineer, university professor, and as IEEE volunteer and leader. The large majority of these contributions are heavily oriented towards industrial applications that IEEE serves. Of particular importance is his development of control technologies by way of intelligence; laying the technological foundations for the production versions of high-performance drives used in an expansive array of industrial, commercial, and transportation applications today. His work covers a broad range of manufacturing and product applications and exemplifies his ability to bridge between academic research and the application to industrial applications.The bridges that Dr. Rubaai has built between industry and academia represent a uniquely valuable contribution that can be matched by very few others in the academic world today.

As an Educator, Dr. Rubaai has been an acknowledged educator and leader of curriculum development at Howard University for more than two decades. He is the Founder and Lead Developer of Motion Control and Drives Laboratory (http://www.controllab.howard.edu) that provides engineering students with valuable hands-on and "real-world" experiences." In recognition of his scholarly work and dedication to the improvement of engineering education, his work is recognized by the larger community of engineering educators, as verified by his receipt of the 2011 ASEE Robert G. Quinn Award and the Distinguished Educator Award of the Middle-Atlantic Section of the American Society for Engineering Education. This recognition is a clear demonstration and confirmation of his peers' high regard for his contributions to engineering education.

ABSTRACT

The study of control systems has been cited as a subject that is heavily based on abstract mathematical concepts. This theoretical base has been considered a major problem with students unable to apply the coursework that is completed in the classroom to real-life systems. This problem has not gone unnoticed in the field of education today, and there have been great leaps in the creation of more "hands-on" teaching methods that lend themselves to industrial applications. At Howard University, the study of control has been accelerated by the integration of motion controls laboratory, which affords the student an opportunity to interact and utilize an "embeddable dSPACE digital signal processor (DSP)-based data acquisition and control system. This is seen by Howard University as a solution to the need for a cost effective, "hands on instructional laboratory" which would "adequately provide hands on experience necessary for effective learning." Another key aspect of this laboratory is the close integration of the conventional simulation tools MATLAB and SimulinkTM. Under this unique environment undergraduate students may well perform computer simulation, evaluate the simulated response of a system, develop, and verify the performance of traditional and advanced control laws in a simulated mode. The students can then easily install the developed controllers to hardware all within the same routine interface. The fundamental student learning outcomes of the control education with laboratory experimentation are to demonstrate the following:

- An ability to design, build, or assemble a part or product that configures control systems especially adapted to automation applications.
- An ability to achieve adequate learning skills in testing and debugging a prototype using appropriate engineering tools and learn how to be an experimenter.
- An ability to conduct experiments for measurements and analysis of feedback controls, and to write effective laboratory reports.
- An ability to use MATLAB/ Simulink graphical-user-interface (GUI) to build a real-time model.
- An ability to use dSPACE DSP GUI for real-time control.

Through the modeling of different types of controllers, students are expected to gain a better understanding for the differences between various controllers as well as a greater appreciation of how they are applied to real life.