

Auburn University

Summer 2005 Newsletter Vol. 6, No. 1

Electrical and Computer Engineering

Samuel
Ginn
College
of

Engineering

IEEE names ECE faculty as fellows



Charles Stroud

Three members of the electrical and computer engineering faculty have been named fellows of the IEEE. Charles (Chuck) Stroud, Yonhua (Tommy) Tzeng, and Mark Halpin, Alabama Power Distinguished Professor, were among 268 IEEE senior members named as fellows effective January 1. The IEEE has more than 365,000 members in approximately 150 countries.

According to its Web site, the IEEE grade of fellow “is conferred by the board of directors upon a person with an extraordinary record of accomplishment in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth of one percent of the total voting membership.”

Stroud, who came to AU from the University of North Carolina at Charlotte in 2003, was recognized for contributions to Built-In Self-Test (BIST) of integrated circuits. His professional involvement includes associate editor for BIST for the *Journal of Electronic Testing: Theory and Applications*, vice program chair of the IEEE North Atlantic Test Workshop, and member of the technical advisory board of DAFCA, Inc., an electronic design automation software company.

A researcher with more than a dozen patents to his credit, Stroud has garnered numerous awards for excellence in instruction. He teaches undergraduate classes in digital logic and digital system design and graduate classes in computer-aided designs of digital circuits, among other topics.

Students, faculty develop technologies in BIST lab

The basic idea of Built-In Self-Test (BIST) is to design circuits to test themselves. This technique was first proposed 25 years ago and has become one of the most important testing techniques for integrated circuits and systems.

The faculty and students of the Auburn University Built-In Self-Test (AUBIST) Laboratory have been doing groundbreaking work in BIST for relatively new but difficult-to-test technologies — Field Programmable Gate Arrays (FPGAs) and System-on-Chip (SoC) devices. FPGAs are prefabricated integrated circuits that can be reprogrammed in the system to perform any digital logic function. SoCs typically contain FPGA cores along with embedded memory and microprocessor cores.

In BIST for FPGAs, the device is reprogrammed to test itself such that no extra or dedicated circuitry is needed for testing. The results of the BIST are then used not only to determine whether these devices are faulty, but also to identify the faulty components within the device. The intended system function can then be reprogrammed to avoid the faulty components within the device to facilitate fault and defect tolerant applications.

In the past year, researchers in the AUBIST lab have moved the BIST reconfiguration and diagnostic functions into the embedded processor in SoCs such that all test and diagnosis is performed on-chip. This technique is not only self contained on the SoC for on-demand in-system test and diagnosis, but provides a 30-fold acceleration in testing over the previous approach to BIST for FPGAs.

Graduate and undergraduate students in the AUBIST have also designed and constructed a printed circuit board (see photo) for developing and demonstrating their BIST and BIST-based diagnostic approaches for FPGAs and SoCs. The printed circuit boards contain two different SoCs, each consisting of an embedded processor with program and data memories along with different size FPGA cores. This research is sponsored by a contract from the National Security Agency and a grant from the U.S. Army Space and Missile Defense Command.

The research effort is directed by Chuck Stroud, who joined the ECE faculty in 2003. A graduate of the University of Kentucky (BSEE 1976, MSEE 1977) and the University of Illinois at Chicago (PhD EE and CS 1991), Stroud spent 15 years in industry as a distinguished member of the technical staff at Bell Labs, where in 1981 he became one of the first people to work in the area of BIST.

Stroud developed the first BIST for RAMs, the first completely self-testing integrated circuit, the first BIST for mixed-signal systems, and the first BIST for FPGAs. He holds 13 U.S. patents in the area of BIST and is author of a recent book entitled "A Designer's Guide to Built-In Self-Test." He was named fellow of IEEE in 2005 "for contributions to built-in self-test of integrated circuits."



The goal of Built-In Self-Test (BIST) is to design circuits to test themselves. Researchers in the AUBIST laboratory have designed and constructed this printed circuit board for developing and demonstrating their BIST and BIST-based diagnostic approaches for Field Programmable Gate Arrays and System-on-Chip devices.