Restructuring Electronic Circuits Education Around Integrated Circuit Technology of the Year 2000

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With teaching and research backgrounds in electronics, integrated circuit design and computer architecture, we have been experiencing a rapidly growing interest in industry from around the country in providing more engineering graduates that can support the greater information technology field. Paralleling this interest was an increased industrial emphasis on graduates with M.S. or Ph.D. degrees and increasing comments from industry that they can no longer serve key high-tech design requirements with B.S. graduates. In 1995 we took an in-depth look at the part of our curriculum that is educating students pursuing electronic design career paths and made a startling discovery. In spite of the fact that our focus is very similar to that at peer institutions from around the country, most of the material in our introductory electronic circuits course was based upon 1960's technology. This was further made apparent with the increasing difficulties we were having at locating components for the laboratories - components that we were using were becoming obsolete by the vendors. Further investigation and discussions with industry led us to the conjecture that one major contributor to the reluctance of industry to hire B.S. graduates into key high-tech design positions is the inadequacy of a 1960's toolset for solving problems of the 1990s.

We are in the midst of a major restructuring of how electronics education is approached from the earliest introduction in the basic electronics course through our most advanced Ph.D. courses. ***We were fortunate to obtain NSF support through the ILI program to instigate a restructuring of the basic electronics circuits course***. This course now focuses on integrated electronics designed in state of the art semiconductor processes. In the course, students use state of the art CAD tools in the design of simple integrated circuits and in the laboratory students will use test equipment suitable for characterizing the performance of semiconductor devices and circuits using current technology. Although initial concerns of curricular compression arose as well as concerns about time spent with discussing semiconductor technology and CAD tools would detract from fundamental concepts in device operation and circuit design, we have found that it is actually easier to focus on basic electronic circuits concepts in an integrated electronics environment and we believe that students will develop a better understanding of fundamental principles with this approach. Providing a gateway to the semiconductor technology field at this level is also generating considerable student interest in pursuing a career path in the area. As students complete our new introductory electronics course, we will be in a position to provide more depth in our higher-level elective courses in the field.

Paralleling the ongoing restructuring of the basic electronics course has been a major development in what we call our graduate VLSI program which initially is focusing on analog and mixed-signal VLSI design but which will be expended to include digital design and CAD as faculty resources become available. In the graduate program, we maintain strong ties between the teaching and research program and strong ties with industry. Current efforts focus on identifying fundamental research problems associated with leading edge applications that support the information technology field. This focused approach, which was effectively started in late 1995, has generated considerable industrial interest as well as considerable student interest. In January 1996 there were under 5 graduate students working in our Analog and Mixed-Signal VLSI Program.

By the fall of 1997 that number had increased to over 45 and projections are for it to grow to about 55 by the fall of 1998. Sponsor commitments to the program since January 1996 are in excess of $3.5 million with most of the support coming from industry. Graduate student applications for the program are growing rapidly as is the quality of the applicants. To maintain close ties with industry, graduate students regularly participate in industrial internships and these are paralleled by regular visits by faculty to industry. We are also working closely with industry in some key design paths in an attempt to dispel the perception that delays in an academic environment preclude university involvement is such activities. A list of some of the ongoing research projects follows.

1 Gbit Fiber Channel Transceiver
1 Gbit Ethernet over twisted pairs
Use of monolithic magnetic materials (MR and GMR) in sensing and memory applications
High-speed and high-resolution data converters
High-performance amplifier design
Low voltage linear circuit design
Field programmable mixed analog and digital arrays
High frequency VCOs, charge pumps and clock recovery circuits

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Additional information about the NSF ILI project, about the curriculum restructuring, or about the research program, can be obtained from any of the following faculty members:

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