PHYSICIST-TO-ENGINEER: A GRADUATE PROGRAM RECRUITING TOOL

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Abstract — In this work-in-progress paper, we report on a rigorous, time-condensed program to prepare graduates with a Bachelor of Science in physics for graduate study in electrical, computer, and telecommunications engineering. Due to the ongoing favorable job market for engineers, we have found it increasingly difficult to recruit quality students into our graduate programs. In fact, this is recognized as a nationwide problem. We have identified the national pool of undergraduate physics majors as a prospective group of students who can excel in graduate engineering studies. We have established a rigorous eight-week curriculum, to be offered during the summer term, that provides the necessary prerequisite material, including: microprocessors, signals and systems, electronics, and an integrated laboratory experience. This “summer academy” is designed to eliminate the need for normal session leveling classes that students without electrical or computer engineering degrees are required to complete, thereby reducing the overall time required to get a graduate degree.

Index Terms — curriculum, graduate studies, recruiting

Motivation

We have found the recruitment of quality students into our graduate programs in electrical, computer, and telecommunications engineering to be increasingly difficult given the robust economy and competitive job market of the last several years. This problem is not isolated, but rather is nationwide. We have identified the national pool of graduates with a Bachelor of Science in physics as a prospective group of students whose educational background in science and mathematics can lead to a relatively smooth transition into graduate engineering studies. In particular, physicists’ background in electricity and magnetism minimizes the need to screen for this essential prerequisite. As a recruitment incentive to highly qualified students, we offer industry-sponsored scholarships that cover all tuition and fees. In this work-in-progress paper, we briefly describe a curriculum designed to speed the transition from physicist-to-engineer, eliminating the need for the leveling classes that students without electrical or computer engineering degrees are required to complete, thereby resulting in their more rapid assimilation into our graduate programs.

Our program presently offers the M.S. and Ph.D. in Electrical Engineering, which broadly covers both traditional electrical engineering and computer engineering areas. We also offer a M.S. in Telecomputing, largely focused on telecommunications engineering.

Curriculum

In our rigorous eight-week curriculum, instruction is focused in four subject areas:

- Microprocessor system design—the use of microprocessors and logic design using microprocessors with emphasis on the assembly of fully functional units into workable systems.
- Signals and systems—the use of transforms in analysis and design, state-space methods, feedback and communications systems, introduction to stochastic processes.
- Electronics—small and large signal characteristics and models of electronic devices; analysis and design of elementary electronic circuits.
- Laboratory—an integrated laboratory experience that encompasses the design and analysis of analog and digital circuits and systems.

Realizing that physicists have varying background in computer programming, fundamentals of digital logic design, and circuit analysis, we incorporate review materials into the instructional modules listed above. We also include introductions to communication theory and digital signal processing, since these support vital research areas in our graduate program.

Classes meet four days a week for eight weeks during the summer term. Three of the four days are devoted to lectures (five hours per day), interspersed with homework/study sessions (two hours per day) in which the students have ready access to instructors. This format provides continual feedback to the students.

As we refine our summer academy curriculum through experience and feedback from assessment tools, we see potential to open up enrollment to students from other academic disciplines, such as mathematics and computer science. At FIE 2001, we will present the results of our preliminary assessment and address “lessons learned.”

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