THE EVER-EVOLVING FIELD OF ELECTRICAL ENGINEERING

I WAS AT A LARGE HARDWARE STORE, holding a power cord that I thought would fit my new home generator, when another shopper pointed to the cord in my hand and said that I had chosen the wrong connector. When I looked hesitant, he added, "I'm an electrical engineer, so I know things like that." ● Needless to say, I quietly changed my choice. But I started thinking: What are those things that *all* EEs know? What is the commonality of training and experience that holds us together as a profession, and how is it changing? What will it mean to be an EE in the future? ● I looked at the EE curricula in a number of universities. In the first two years of study, there is a lot of uniformity, with courses in basic math, physics, and computing. The EE-specific part begins with circuit analysis and design. After those first two years of school, however, EE students branch out in perhaps a half dozen different directions. A student who studies the physics of electron devices might have little in common with one who studies information theory. But each would be an EE, and almost the only specialized knowledge that they would hold in common other than basic science and math would be the principles of circuit design. So I decided: You are an EE if you know—or once knew—circuit design. ● After college, EEs enter so many different specialties and occupations that they are almost impossible to categorize. Nonetheless, I looked at the IEEE organization as a framework for professional practice. There are currently 39 societies within the IEEE that serve to guide publications and conferences. As engineering practice changes, so must the societies, yet over the last 20 years only a few societies have been added and one has disappeared, which indicates only moderate evolution. However, even the oldest societies mutate their domains while maintaining their descriptive legacy names. In addition, many societies have generic names denoting a function, rather than an underlying technology, such as the IEEE Communications Society.

Wikipedia defines electrical engineering as "a field of engineering that generally deals with the study and application of electricity, electronics, and electromagnetism." But it seems to me that we have moved well beyond that classical role. Many of the problems today are at the layers above the physical level, involving software, systems, algorithms, design, and cognition, and are usually cross-disciplinary. For example, the most hyped technologies today include machine learning, big data, security, autonomous vehicles, robots, and the blockchain. While electronics is the enabler in all of these, it is not where the important problems are. Nonetheless, we electrical engineers have already occupied this higher ground, as our training, aptitudes, and inclinations seem well suited for this work.

Practicing engineers will go wherever there is interesting work. My concern is more with the evolution of the educational and professional institutions that support engineers, and with the perception of electrical engineering held by potential students. The IEEE has already had at least two episodes of soul-searching over the scope of its domain—in 1963 when it incorporated "electronics" into its name, and some years later when it wrestled with the role that computer science would play.

As circuit design and other classic electrical engineering tasks are increasingly performed by computers and electrical engineers move to ever higher and more functional design, what will be the commonality that holds us together in the future? And how will electrical engineering be distinguished from other branches of engineering?

When I first entered electrical engineering in college, I had very little idea of what EEs actually do. After all these years, I'm still not sure. ■

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