

Options for Continuing Your Engineering Education

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Learning is a lifelong process that is enabled by many resources, venues and institutions with an emphasis on engineering at high frequencies

All engineers need, and usually want, a continuing process of learning. Whether keeping up with technology in a specialty, or gaining understanding of additional design areas,

an ongoing education is essential for both the present job assignments and for seeking career advancement.

This is our monthly tutorial article, and it is directed to new and less-experienced engineers. Engineers with more experience will know about these education opportunities and are encouraged to show this to their younger colleagues, adding their own insights.

We'll review the primary methods of continuing education, beginning with the simplest and most accessible and progressing to the most in-depth, formal learning options.

Self Study: Conferences, Libraries and Internet

Although not always considered "continuing education," self-study is the method most often used to gain specific knowledge required to complete a design assignment. The available resources are many, including:

Conference papers—Attending a conference has the advantage of being able to ask the author questions, as well as hearing the questions of others. But conference proceedings are nearly as good, since contact information for the authors is usually included, which allows the same question opportunity. These papers may report on the latest research, or more typically, will describe the authors' investigations of a specific topic.

Libraries—Until all past reference books and textbooks are archived online, the library stacks will remain an essential place for directed study. University libraries, company libraries, and personal collections represent opportunities to learn from the best researchers and teachers of past years. And whether paper or digital, every engineer should develop a collection of reference books that provide either answers or inspiration (or both) when new problems need to be solved.

Internet research—Online resources are growing literally by the hour. From formal conference papers to personal research notes, there is a wide range of information available on nearly any topic. The greatest difficulty is intelligent search methods to avoid the problem of sorting through too much irrelevant material.

There is also the problem of reliable information, since most web sites and information contributions are not reviewed by any qualified body—there may not be a Technical Program Committee or Editor responsible for Internet technical content! So be sure to use the simple rule of verifying the information against other sources.

Others—Other methods of self study include working with a mentor, asking an expert for assistance, or taking some extra time to experiment (if working on hardware).

Internal Company Seminars

The remaining areas of continuing education are more formal, beginning with internal seminars. These have become less common in recent years but are still considered important at a significant number of companies. At the very least, all companies provide resources for

becoming competent on the company's products and technologies, design methods, EDA tools and laboratory test equipment. If a young engineer is lucky enough to be working at a company that offers seminars taught by senior staff, he or she should never miss one!

Conference Tutorial Seminars

A similar type of formal, but experience-based seminar are those often included at technical conferences. For a modest additional fee, these provide concentrated training—usually on a recent technology that is in the process of moving from research to engineering development. Thus, these seminars are an excellent way to stay current. A few recent topics I've seen include power amplifier linearization, MIMO, System-on-Chip (SoC) and System-in-Package (SiP), and digital signal integrity.

Supplier-Provided Seminars and Webinars

Although part of a sales and marketing effort, seminars developed to highlight a supplier company's product almost always include solid technical instruction that illuminates the design issues that their products address. Besides being free, perhaps the best reason to attend these seminars is that the instructors are usually some of the best engineers in their field. After all, products and software are developed by engineers at those companies, just as you do at your company. Because those products are typically specialized—instruments, software, components or materials—their design and application support staffs are typically at the leading edge of that technology.

Formal Short Courses

While many seminars fit the category of a "short course," they may not be ongoing offerings or be built with a well-planned and continually updated curriculum. The definition of short course used here is typically a one-day to three-day class on a particular topic, including a reference textbook, class notes, and classroom-style presentation by an experienced teacher.

These courses may be offered by individual trainers, provided through supplier companies, or as part of a university continuing education or professional development program. This magazine and most professional publications include listings of short courses.

Training Companies

A few companies specialize in short course instruction. Their main advantage is access to a range of topics from a single training vendor. These companies may also host training events, offering a selection of popular and timely subjects in an open-enrollment environment. They will also provide a selected curriculum for in-house training. There are only a few of these companies, although some university programs may have similar operations.

University Distance Learning

Formal college coursework is a common option for a BSEE, both for personal development and career advancement. This involves a greater time commitment and financial cost than any of the previous options—but the student can eventually attain the greater reward of an advanced degree.

Online courses, or *distance learning*, is one option, with the advantages of a more flexible time schedule and off-campus location, perhaps even thousands of miles away. The primary disadvantage is a less personal environment and the need for greater personal discipline in performing the required work. When these factors represent the best option, online study is a good choice.

Classroom Instruction

When an institution is nearby (or a reasonable commute), and when the student prefers an in-person, regularly scheduled classroom experience, then on-site university study should be considered. There are also a few institutions that actually charge higher tuition for online courses, presumably because they require more of the instructor's time to give an appropriate amount of attention to individual students.

Classroom study is probably the best option for the most advanced work. Few companies will have laboratory facilities that match the curriculum and the interaction among graduate students that helps work out many of the issues that arise while pursuing significant research. Regular interaction with faculty, and the presence of a truly academic environment are additional factors that may make this a preferred educational option.

It may be possible to do an advanced degree with a combination of distance learning and on-campus work. I am aware of PhD programs in engineering and other fields of study that allow online work in some classes, but typically requires on campus attendance for one year's work as the degree requirements are completed.

Summary

The underlying message is stated in the box at the beginning of this article, "learning is a lifelong process." How you pursue your ongoing education will depend on your specific needs, from finding the solution for a small design problem to obtaining an advanced degree and looking for a promotion or better job at another company. Hopefully, these notes provide ideas of where to start.

Although it would be useful to provide a listing of pertinent education and training providers, I found it impractical—attempting to make a list would inevitably omit some of the important ones. There are many places where seminars, short courses and other formal instruction are listed, and I recommend that you develop your own list to fit your area of engineering interest.