Session 1526

Improving the Effectiveness of the Electrical Engineering Service Course

The objective in this project is to improve learning outcomes from electrical systems courses often included in undergraduate mechanical engineering (ME) curricula.

Our methods involve three primary elements: 1)integration of the course into the mechanical engineering curriculum, 2) development of course material that maximizes the relevance of the course to mechanical engineering students, and 3)development of tools for effective delivery of this material.

Integration of course into the ME curriculum

Prior to this project the course prerequisite was one engineering science course in electrical systems. No course in the ME curriculum listed this service course as prerequisite.

The course is now part of an integrated sequence in the ME curriculum. Its prerequisites include two engineering science courses—one in electrical systems and another one in engineering systems. The service course is prerequisite for a required ME core course, mechanical measurements. Previously, students could delay and take the course as last term seniors. The results were predictable—students had difficulty in recalling material from previous courses, and they were aware that future courses would not build on the material. All they had to do was to pass. ME students now take the course the term immediately following its prerequisites. They know a significant amount of the material will be used in subsequent courses in their major and see the course as part of their major and the material as relevant.

Development of relevant course material

We worked closely with faculty from mechanical engineering to develop material that they feel is of real use to ME students. The major change resulting from this collaboration is that 40% of the course is now devoted to measurement—examples are strain, temperature, and acceleration. Another change is that two weeks, and two labs, are devoted to an introduction to control systems. Our plan is for this course to become prerequisite for the ME controls course. We continue to work closely with ME faculty in the development of material for the course sequence that makes sense for the students.

Development of tools for effective delivery

The class has a studio format with three 2-hour sessions each week. This combination, studio format and 2-hour sessions, permits flexibility in laboratory, lecture, and demonstration. Before the course was largely talk-and-chalk with no hands-on element. Now, there is usually more than one hands-on experience each week. This is further supplemented with frequent demonstrations.

An important aspect of the classroom is an instructor demonstration bench with integrated camcorder. This permits the instructor to guide the entire class in system construction or measurement technique. Several basic items (oscilloscope triggering, op-amp circuit construction, for example) have been recorded, with soundtrack, digitized and placed online.

The Mallard® online quizzing system, developed at the University of Illinois, is employed to provide students an effective studying medium. The online quizzes are designed so that students obtain immediate context specific feedback based on their answers. We feel this quick feedback is an important pedagogic element in the effectiveness of the system. Students are allowed to take the online quizzes twice and still receive full credit. It has become apparent that these online quizzes are an effective learning tool that encourages students to come prepared to class. Records show that students frequently spend 20-30 minutes taking each online quizzes. Online quizzes are then often followed by in-class quizzes.

To further encourage students to study outside of class, online tutoring tools, both static and interactive, have been developed to aid asynchronous learning. The static tools are problem solutions presented in an intuitive point-and-click format. The intent is to encourage and enable self-guided study. Students are able to guide their own learning in the context of specific examples. The multileveled structure of the problem solutions, together with sufficient depth, make the tool useful to students of all abilities. The interactive tools are used by students as drill to help them become proficient with, for example, nodal analysis, phasor analysis, or signal conditioning.

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