

IT-Enhanced Laboratory Experience within a Modern Undergraduate Engineering Curriculum

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Abstract

The emergence of Information Technology (IT) is enabling engineering educators to constantly reconsider both the content and means of delivery of modern undergraduate curricula. Online learning environments are rapidly becoming viable options for providing students with a bridge from theoretical concepts to practical engineering applications. They can be made to represent repositories of integrated tools that provide a delivery mechanism for rich learning content, advanced assessment capabilities as well as affordable access to a wide range of other resources. Online educational environments have been used at Stevens Institute of Technology (SIT) to provide undergraduate engineering students with a comprehensive laboratory experience based on content-rich and flexible remote and virtual laboratory experiments.

The concept of online laboratories (i.e. remote experiments based on actual physical devices and/or virtual experiments representing pure software simulations) is being expanded through the use of information technology to create standardized laboratory, experiment, device and enhanced simulation descriptions so that students can run experiments that may involve multiple devices in different laboratories at various locations, perform collaborative experiments with multiple participants, and combine experiments and simulations into one integrated experience. Dealing with this matter, the paper presents a collective effort to design, implement and evaluate integrated laboratory system for delivering both remote and virtual laboratories. The methods and software modules implemented and the pedagogical approach developed for integrating them into a comprehensive student laboratory experience have been used in a sophomore-level core undergraduate course on solid mechanics taken by all undergraduate engineering majors at SIT as well as in a junior-level course on mechanisms and machine dynamics for mechanical engineering majors. Some results of learning outcomes assessment conducted over a period of time will be presented.