

Telepresence – Virtual Laboratory Experiences Using Real-Time Control and Interactive Simulations over the Internet

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The exponential growth in Information Technology in general and the global presence of the Internet in particular has resulted in a large set of instructional documents and streaming video and audio lectures available on-line. Instructors can now also interact at will with remote students using electronic mail and video-conference tools. Traditional universities as well as emerging virtual universities are responding to this evolution by proposing and seriously beginning to assess synchronous or asynchronous distance learning curricula. Students whose circumstances do not allow them to attend traditional campus bound, time scheduled classes now have very flexible access to quality instruction.

Unfortunately however, the material typically provided on-line is often incomplete and inadequate for engineering education and training. Indeed in this field as with several others such as medicine, the practice is the missing component and this is often the key to becoming an effective professional.

In this paper we describe our ongoing work to provide an online practice component as exemplified by the development of distributed online laboratories to support and enhance the delivery of on-line courses on the topic of control engineering. It turns out that the associated infrastructure addresses quite general problems in the area of control and experimentation over the Internet and thus may be extended for other applications as well. For example we have started to extend these ideas to analog and digital communications systems.

Our approach is to allow students direct online access to a combination of actual control or communication hardware and realistic simulations of these systems. The simulations are being written in Java or in the LabView environment, or with the aid of Web-based helper applications. Online control and telemanipulation of hardware subsystems require an appropriate interface between the networked computer (server) and the hardware and for this we are interfacing with products from National Instruments and Feedback Inc.