

A VIRTUAL LABORATORY FOR INTRODUCTORY ELECTRICAL ENGINEERING COURSES TO INCREASE THE STUDENT PERFORMANCE

Manuel E. Macías¹, Victor M. Cázares² and Enrique E. Ramos³

Abstract — The increasing power and availability of software and hardware on personal computers has already begun to revolutionize the way engineering subjects are taught and learned. This paper describes a computer based laboratory, called Virtual Laboratory, to assist and advance learning endeavors in electrical engineering programs at Monterrey Tech. We are focusing our initial efforts on our introductory Circuit Analysis and Electronic course, which are taken by undergraduate engineering students of several programs.

Index Terms — Virtual Laboratory, Virtual Instruments, Laboratory Tools, Computer Based Laboratory.

INTRODUCTION

In the Electrical Engineering Programs the transition from the first course to the electric/electronic courses cause several problems to the students. One reason for this is the fact that these courses are usually the first touch with the Electric Engineering Field. Other reason for this is that the theoretic electric/electronic concepts are often treated separately in a first course, and semesters later students are exposed to reality through practice electric/electronic circuits in Laboratory, which is not very effective.

However, the increasing power and availability of computers (hardware and software) has already begun to revolutionize the way engineering subjects are taught and learned. This paper describes a computer based laboratory, called Virtual Laboratory, to assist and advance learning endeavors in electrical engineering programs at Monterrey Tech. We are focusing our initial efforts on our introductory Circuit Analysis and Electronic course, which are taken by undergraduate engineering students of several programs.

DESCRIPTION

With the primary strategy to combine existing hardware and software components rather than to create new ones, the Virtual Laboratory consists of some tools that simulate the environment of a physical laboratory;

- **Electronic Virtual Laboratory;** A virtual environment of laboratory to analyze and design electric, electronic and digital circuits. The electric and electronic parts, wire connections and measurement instruments are simulated by software in the computer.

- **Virtual Instrumentation;** A set of virtual instruments to analyze the behavior of the physical circuits. The virtual instruments are created by software and operate in conjunction with Data Acquisition Boards. The DAQ Board converts the Physical variables to be measured into a digital format, which can be understood by the computer. The computer controls the DAQ Board operation, and acts as an instrument displaying data on the screen. Instruments such as Oscilloscopes, multimeters, function generators and spectrum analyzers can be implemented.
- **Monitoring and Control Process;** Development of Man-Machine interfaces for Physical System modeling, monitoring and controlling. Control commands, control algorithms, and virtual instruments are created by software in combination with Multifunction Data Acquisition Boards and input/output computer ports.
- **Learning Virtual Environments;** Creation of interactive Learning Virtual Environments as a mean for promoting the students' self initiative to knowledge, exploration and experimentation.

CONCLUSION

The Virtual Laboratory reinforce the lecture material and allows study and understanding of some practical issues which are best handled through a laboratory experiment. Time and effort are optimized and difficulties in assimilating the material are minimized. Students have found this Virtual Laboratory to be a significant help. Because the laboratory tools are very easy to use, the students can begin to design and analyze their electric and electronic circuits by the time they begin to learn them.

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¹ Manuel E. Macías, ITESM, Electrical Engineering Department, Suc. de Correos J, C.P. 64849. Monterrey, N.L. México, mmacias@campus.mty.itesm.mx

² Victor M. Cázares, ITESM, Electrical Engineering Department, Suc. de Correos J, C.P. 64849. Monterrey, N.L. México, vcazares@campus.mty.itesm.mx

³ Enrique E. Ramos, ITESM, Electrical Engineering Department, Suc. de Correos J, C.P. 64849. Monterrey, N.L. México, al771478@mail.mty.itesm.mx