

Project Year

Summer 2009

Project Title

Analog/Digital Biomedical Instrumentation Online Stimulator (AD-BIOS)

Project Team

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Audience

School of Medicine graduate students and seniors in the *Medical Instrumentation* course and Engineering Professional Part-time students in the *Medical Sensors and Instrumentation* course

Pedagogical Issue

The class teaches the fundamentals of medical sensors and instrumentation and includes a laboratory component requiring students to build circuits. Every year some of the students do not have sufficient electronics background to complete the labs and invariably lag behind. In a previous Technology Fellowship project, the team developed online analog circuits and sensor simulation modules used by students in the Medical Instrumentation class to learn important analog circuit skills to complete the lab. The project, titled BIOS, was extremely useful but did not cover the digital circuits also taught in the class.

Solution

This project will develop digital circuit simulations to augment the work completed in the BIOS project, creating a complete toolset for the course. Students will be able to experiment with a variety of sensors, analog and digital circuit designs, and get a very good understanding of the circuit principles, the parameter setting and how different variables affect circuit performance. This becomes an exciting first step between lecture and actual lab work. The value of the simulators lies in providing an easy way to test various parameters and how they affect the results.

Technologies Used

VHDL simulator, JAVA, CGI/Perl

Project Abstract

The Analog/Digital Biomedical Instrumentation Online Simulator (AD-BIOS) is a web based analog and digital circuit simulator for the biomedical instrumentation courses, 580.471 (BME, fall) and 585.408.31 (Engineering Professional Program, spring), taught by Dr. Nitish Thakor. The classes teach the fundamentals of medical sensors and instrumentation. They have a strong laboratory component requiring students to build circuits. Every year some of the students do not have sufficient electronics background and invariably lag behind. An analog-only version of the tool, BIOS, was developed under a

Technology Fellowship grant in 2004 to be a simulator for those students to come up to speed and to serve as a design test bed for the more advanced students.

We are now proposing to extend the tool to digital circuits as well, which are critical in instrumentation for any digital processing or computer interfacing. Similar to BIOS, AD-BIOS will consist of a set of front-end Java applets. These describe the circuits that users can simulate. Users can modify circuit parameters and choose the required analysis. On the web server, a set of CGI/PERL scripts convert the users' design into a circuit net list and send it to the simulation engine. We will retain the Berkeley SPICE simulator used by BIOS for analog circuits and add support for GHDL, an open source implementation of a VHDL simulator that is commonly used to simulate digital circuits. The simulation will be carried out entirely on the web server and will be transparent to the user. Using PERL and the GNU plotting utility gnuplot, the results will be presented back to the client. We will create the AD-BIOS framework, add to the current library of BIOS simulations, and create new digital libraries for use with AD-BIOS.