Teaching System Dynamics with Arduino, MATLAB, and Simulink

Last updated: 10/18/2013

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Course Details

Description

The haptic paddle (shown in Figure 1) is a motorized force-feedback joystick which allows students to feel forces generated by interactions with various virtual environments. It was originally developed and used as a teaching tool for dynamic systems at Stanford University. Since then, many universities, including Johns Hopkins University, Rice University, University of Michigan, and University of Utah, have contributed to the development of this inexpensive, portable haptic device (see the EduHaptics webpage for more information). At Vanderbilt University, we have incorporated the haptic paddle in the System Dynamics laboratories (see below) and have made many improvements in both hardware and software. These improvements are efforts from the Medical and Electromechanical Design (MED) Lab in the Department of Mechanical Engineering. In collaboration with California State University Long Beach (CSULB), we have also implemented the haptic paddle into an Introduction to Mechanical Engineering course and a graduate level haptics course (materials coming soon).
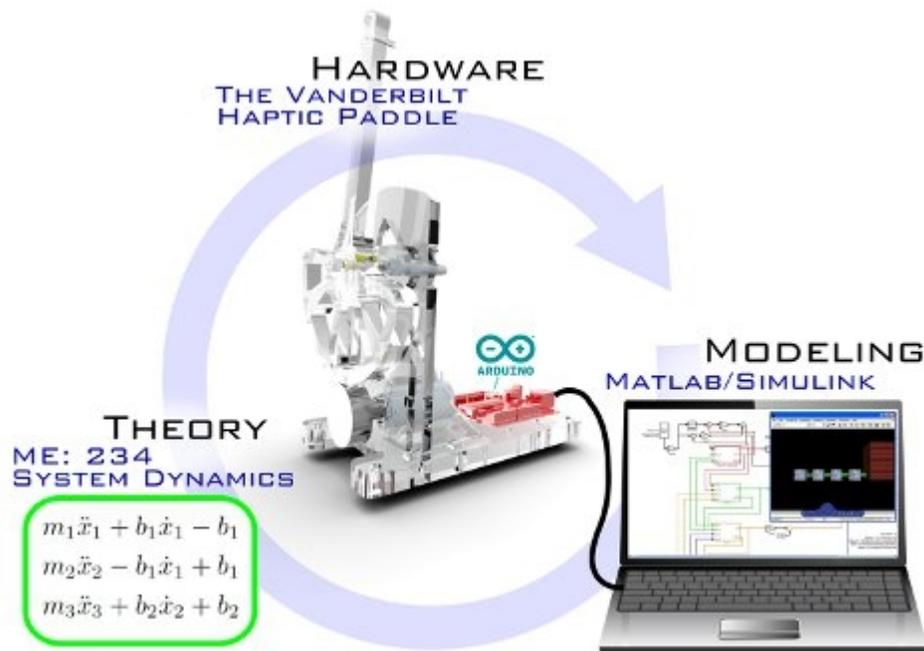
Figure 1: The haptic paddle laboratory enables students to apply theoretical concepts learned in lecture to characterize their physical hardware, integrate it with electrical hardware, and "close the loop" through modeling and simulation.

Additional Notes

Original Course Documents

Source file URL

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Using an Analog Magnetic Angle Sensor

Lab Session 01

- Motor Spin Down Test

Lab Session 02

- Characterizing the Haptic Paddle Components

Lab Session 03

- Equivalent Systems

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Lab Session 01

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Quizzes

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Quiz 02

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Quiz 03

- [Pre-lab quiz](#)
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Quiz 04

- Pre-lab quiz
- Post-lab quiz

Quiz 05

- Pre-lab quiz
- Post-lab quiz