Inverted Pendulum System:Software

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Introduction:

Previous work has demonstrated that availability of hands-on educational devices significantly improves student learning. Thus, our objective is to supplement a University of California Los Angeles engineering Control Systems class (EE-141) in order to provide students a great hands-on and in-depth experience on control systems while simultaneously providing a cost effective system.

Our ideal achievement would be successfully replicating an inverted pendulum system using inexpensive hardware and software that would allow students to build their own system outside of the classroom so that they can receive a better understanding of controls systems through self-exploration.

Problem Description: Providing an In-depth and Cost Effective Experience

UCLA is revising the course curriculum for the Engineering Control Systems (EE-141) class to make it more engaging and useful for students. We have developed a supplement for the class that will provide students a better understanding of control systems, utilizing an Inverted Pendulum platform. We are adjusting the curriculum by integrating an in-depth discussion as well as providing an at home "laboratory environment" in which students can test their own control algorithms. The platform also allows the opportunity to learn basic circuit analysis and build a real-time controllable device. To further facilitate student learning, a graphical user interface was constructed to allow for implementation by a more diverse body of students. Inexpensive equipment was purchased for the goal of successfully building a personalized system that can be used on the students own time.

Proposed Solution: Supplementing EE-141 with I.P.S using Proposed Components

Encoder

The GUI, to the right, is the Encoder Tracker which tracks the changes of the angular position of the pendulum and the correlating voltage change to the motor. It was constructed with a diverse user group in mind, meaning that anyone from any background should be able to intuitively operate the interface, thus, minimizing the learning curve.

GUI Blocks

To the right is a sample of code written via Labview's GUI blocks. Engineers and scientists commonly used this platform as an easily setup automated measurement, testing, and control systems for those who are not adept at programming code, but it still allows the full potential of programming. Additionally, it has various API's such as Mathscript that allow programmers to write code using traditional means if it comes a case that it is more effective method than the blocks.

Discussion

Although the Encoder Interface was designed with a broad range of users in mind, it can not be determined now how effective the interface is. However, it did prove highly useful when debugging the code which can possibly allude that it will have the same effect on students. The general process in building this platform can be considered difficult, but in comparison with other I.P.S. , it should be relatively easier. This supplement should be of great use to the control systems class.

Encoder Interface/ GUI Blocks