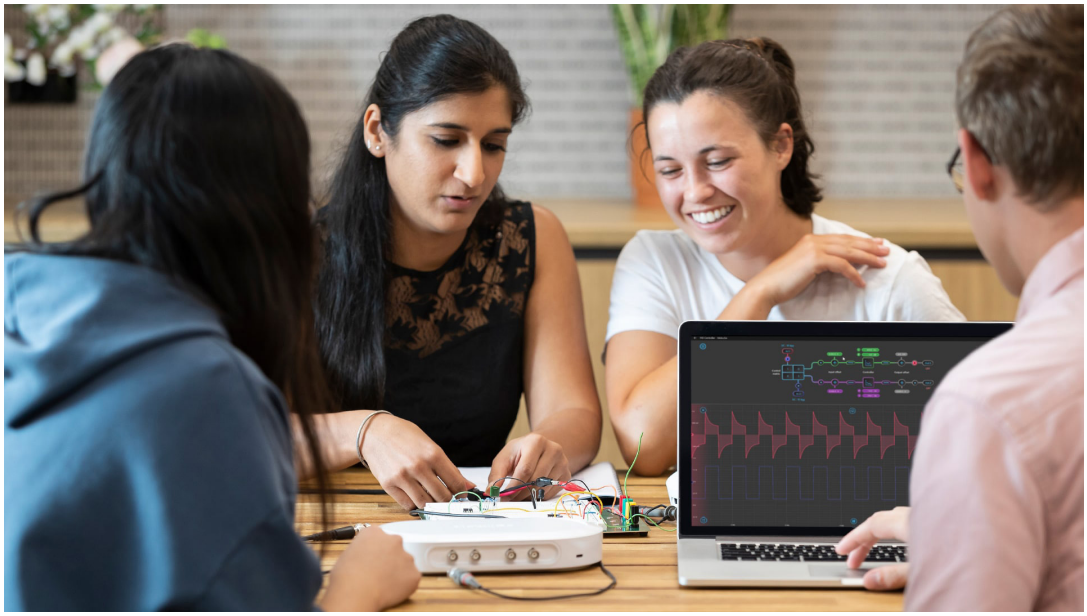
Control Systems

With Moku:Go

Control Systems concepts are fundamental across engineering disciplines. Mathematical foundations are applicable across mechanical, electrical, chemical, and computational use cases. Catering practical examples to students with diverse specializations can be a challenge. Students must not only learn their S's from their Z's, but keep that knowledge connected to physical behaviors.



Moku:Go's instrument suite enables a complete lab program in Control Systems. The PID Controller instrument offers easy time and frequency-domain configuration, providing the core of the program. System Identification can be accomplished in the time domain with the Arbitrary Waveform Generator and Data Logger, or in the frequency domain with the Frequency Response Analyzer. Simple yet powerful API integration for MATLAB and Python ties the real world to the System Identification Toolbox or SIPPY respectively, and provides a seamless link between simulation and practice.

Moku:Go Specs and Features

Key Specs

- 2 analog inputs at 30 MHz
- 2 analog outputs at 20 MHz
- 125 MSa/s sampling rate
- 16 channel digital I/O
- Up to 4 channel programmable power supply

Features

- 11 integrated lab instruments
- API integration for Python, MATLAB, and LabVIEW
- Intuitive software for Windows and Mac

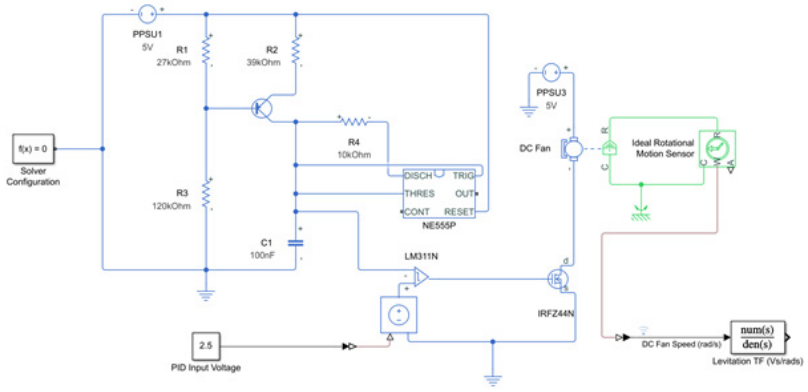
For full specifications and education pricing, please contact edu@liquidinstruments.com

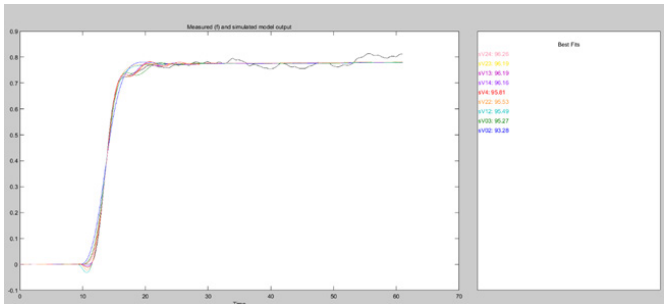
Lab Concepts

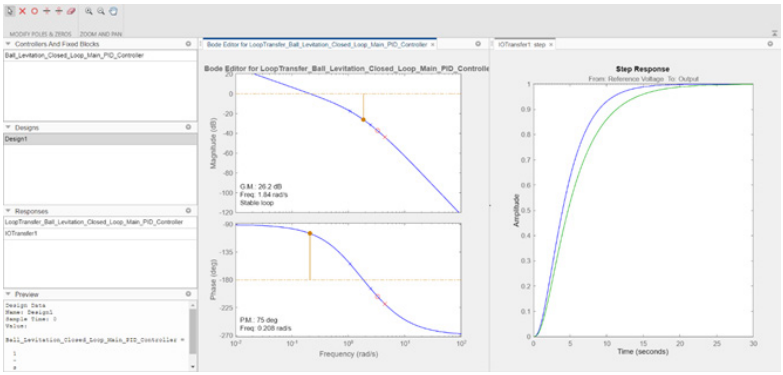
System Identification and Modeling

Students can begin their journey with White/Gray/Black Box mixed domain system modeling using MATLAB or open-source tools. Full electrical simulations can be supplemented with I/O or State Space models, improving understanding by reducing complexity in System Identification.

The real-world system can be excited and characterized in the time domain with the Waveform Generator and Data Logger, or in the frequency domain with the Frequency Response Analyzer. Model response is compared to real-world response and non-idealities can be identified.







Control Tuning and Optimization

With the real-world system now modeled, controllers can be designed and characterized in simulation. Design criteria can be evaluated and parameters rapidly updated.

Setpoint trajectories from real scenarios can be imported from Moku:Go's Data Logger and used to excite the system, keeping them connected to reality.

PID Implementation and Heuristics

PID control parameters designed using simulations of the plant model can now be brought back to the real world. The students will learn quickly that a model is no substitute for reality, and the difference between expected and actual response can be quantified using the PID Controller's built-in oscilloscope monitors and measurement functions.

Both closed loop characterization and control parameter refinement can be carried out in the time or frequency domains, allowing students to build mental models and deep intuition in a way that works for them.