Classroom Content: Control Theory

This collection of MapleSim and Maple classroom materials makes it easy to bring modern technology to any introductory course in control design. With interactive classroom demonstrations that illustrate key concepts in a highly visual way; engaging lab projects and assignment questions; and example models ready to be explored, this material can be used to enrich lectures, make lab problems more concrete, and deepen understanding.

While designed primarily with instructors in mind for use in a classroom or lab setting, students working independently will also find this material useful to improve their understanding of control design.

Content

Using Maple and MapleSim

Transient response with transfer functions and state space.mw: This worksheet introduces users to the DynamicSystems package and shows how to create dynamic systems objects for transfer functions, state space, and zero-pole-gain. Users will also learn how to use the StepResponse command and how to extract system response information such as settling values.

Mass Spring Damper.mw: This worksheet shows how you can build a mass spring damper model in MapleSim, and how to extract the system equations in Maple. The document also shows electrical analogs to mechanical components and gives instructions for building an electrical circuit that is equivalent to the mass spring damper.

Controls mechanical.msim: The MapleSim model for the mass spring damper, as outlined in the Mass Spring Damper worksheet. A document showing the equation extraction can be found under the tab Project > Attachments > Documents > Equations.mw.

Controls electrical.msim: The MapleSim model for the electric circuit that, as outlined in the Mass Spring Damper worksheet. A document showing the equation extraction can be found under the tab Project > Attachments > Documents > Equations.mw.

Class resources

PerformanceSpecs.mw: An interactive worksheet that explores the effect of pole placements on performance characteristics for second order systems.

RootLocus.mw: Root locus plots can provide a great deal of information about a system. Maple's DynamicSystems package provides the RootContourPlot and the RootLocusPlot commands for visualizing the behavior of a system when a control parameter is varied. This worksheet shows how systems with multiple free parameters can be analyzed.

SecondOrderPerformance.mw: This interactive worksheet goes through the effect of pole locations on a second order system. The worksheet visually shows how changing the poles in the S-plane effects the step response in the time domain.

SecondOrderZero.mw: This interactive worksheet goes through the effect of a zero on a second order system. The worksheet visually shows how changing the poles or zero in the S-plane effects the step response in the time domain.

Maple Training for Control Design

Maple Training for Control Design.pdf: This guide provides concise examples for all major topics in an introductory course for control systems. In addition, it provides essential Maple techniques that will help in most topics in engineering.

MapleSim Training

Intro to MapleSim.pdf: This guide provides new users with step-by-step instructions on how to build models in MapleSim.

Labs

Sample mechanical and electrical labs for both Maple and MapleSim.

For more information: www.maplesoft.com