Control System Design with MATLAB and Simulink

Prerequisites

MATLAB Fundamentals and *Simulink for System and Algorithm Modeling* or equivalent experience using MATLAB and Simulink. Also, an understanding of terminology and concepts related to common control systems.

Day 1 of 2	
Control System Design Overview	**Objective:** Provide an overview of the control system design process and introduce how MATLAB and Simulink fit into that process. The details of each step in the design process are covered in later chapters. Defining a control design workflow Linearizing a model Finding system characteristics Setting controller requirements Tuning controllers Testing controllers
Model Representations	**Objective:** Discuss the various formats used for representing system models. Also highlights the pros and cons of each format. Model representations overview LTI objects Simulink models
System Identification	**Objective:** Illustrate how to estimate system models based on measured data. System identification overview Data importing and preprocessing Model estimation Model validation
Parameter Estimation	**Objective:** Use measured data to estimate the values of a Simulink model's parameters. Parameter estimation overview Model preparation Estimation process Parameter estimation tips
System Analysis	**Objective:** Outline the different analysis tools and functions available for understanding system behavior - such as system resonances, transient response, etc. System analysis functions Linear System Analyzer DC motor analysis Automation of analysis tasks Open loop analysis

Day 2 of 2	
Linearization	**Objective:** Discuss techniques for linearizing a Simulink model and validating the linearization results. Linearization workflow Operating points Linearization functions Frequency response estimation
PID Control in Simulink	**Objective:** Use Simulink to model and tune PID controllers. PID Workflow Model setup PID Controller block Automatic tuning Additional PID features
Classical Control Design	**Objective:** Use classical control design techniques to develop system controllers. Common control techniques are covered, such as PID and lead/lag controllers. Open-loop tuning Closed-loop analysis PID control Lead-lag control
Response Optimization	**Objective:** Use optimization techniques to tune model parameters based on design requirements and parameter uncertainty. Optimizing model response Performing sensitivity analysis Optimizing with parameter uncertainty
Controller Implementation	**Objective:** Discuss steps that might be needed to effectively implement a controller on a real system. Identifying physical and practical limitations of controllers Discretizing a controller Preparing a controller for code generation Converting to fixed-point data types