Feedback Control Systems Demystified: Volume 1 Designing PID Controllers

Jack W. Lewis

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NEW Updated Version 1.1

Revised auto-adjust equations and figures that display perfectly in the Kindle Fire HDX8.9, HDX, HD, Kindle apps for iPad and Android Tablets, and more.

A new generation digital book

Contains interactive labs, video tutorials, audio slideshow summaries and workbooks. The book differs greatly from ordinary textbooks on feedback control systems. You learn control system engineering mathematics not by just reading text and studying equations and graphs, you learn by interacting with open-loop and closed-loop dynamic system simulators. You learn how to set gains for proportional, integral and derivative (PID) controllers using computer enhanced root locus plotters. Seventeen simulators are used in a virtual laboratory setting with lab instructions followed by discussions. The instructional material follows a carefully designed step-by-step teaching method with plenty of details so you can't get lost in the math. This is not one of those outline or dummy books, this is a real textbook that utilizes innovative teaching methods.

Step-by-step teaching method

The book begins with detailed mathematical descriptions of electrical, mechanical, fluid, and thermal physical elements. You learn how to combine two of these elements to represent real-life systems that can be modeled using first-order linear differential equations. Interactive simulators let you learn how to solve these math models and produce graphs of system variables as a function of time. Interactive practice workbooks are provided which contain worked problem solutions.

The book continues the step-by-step method by showing you how to model more complex physical systems by combining two energy storage elements to create a math model that can be described by a second-order linear differential equations. Interactive simulators let you learn how to solve these models and produce plots of system variables as a function of time. Interactive workbooks are provided with worked solutions. The concepts of root locus plots and complex variables are introduced using a computer enhanced root locus plotter.

Learn using a design case study

Armed with the knowledge of how to build math models of physical systems, the book describes how these models are used to describe real-life open-loop and closed-loop automatic control systems. A DC motor driven conveyor system is used for the case study. A math model of the system is constructed and used to study the motor torque-speed characteristics and the steady-state power requirements. The dynamics of the system are investigated under open-loop control. A systematic approach is used to study closed-loop speed control. First, a proportional controller is studied to show how proportional control provides control of one of the coefficients of the differential equation describing the closed loop system dynamics. Next, proportional

plus integral control is studied using dynamic simulators and root locus plotters. In the final step, the process is repeated to study a proportional plus integral plus derivative controller.

Supporting website

http://jackwlewis.surberstation.com.

About the author

Educated at the U.S. Coast Guard Academy and MIT, Jack W. Lewis is a registered professional engineer. His specialty is the design of automatic control and instrumentation systems. He is the author of numerous technical papers and articles, including national award-winning papers for the American Society of Naval Engineers (ASNE) and the Society of Naval Architects and Marine Engineers (SNAME).

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James Wood:

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