

PID CONTROL

Araki M.

Kyoto University, Japan

Keywords: feedback control, proportional, integral, derivative, reaction curve, process with self-regulation, integrating process, process model, steady-state error, overshoot, decay ratio, rise time, settling time, gain margin, phase margin, action mode, ultimate sensitivity test, step response test, Ziegler–Nichols’ tuning methods, Chien–Hrones–Reswick’s tuning method, modulus-optimum tuning method, symmetrical-optimum tuning method, anti-windup, two-degrees-of-freedom controller

Contents

1. Introduction
 2. Process Models
 3. Performance Evaluation of PID Control Systems
 4. Action Modes of PID Controllers
 5. Design of PID Control Systems
 6. Advanced Topics
- Glossary
Bibliography
Biographical Sketch

Summary

The PID controller which consists of proportional, integral and derivative elements, is widely used in feedback control of industrial processes. In applying PID controllers, engineers must design the control system; that is, they must first decide which action mode to choose and then adjust the parameters of the controller so that their control problems are solved appropriately. To that end, they need to know the characteristics of the process. As the basis for the design procedure, they must have certain criteria to evaluate the performance of the control system. The basic knowledge about those topics is summarized in this article.

1. Introduction

“PID” is an acronym for “proportional, integral, and derivative.” A PID controller is a controller that includes elements with those three functions. In the literature on PID controllers, acronyms are also used at the element level: the proportional element is referred to as the “P element,” the integral element as the “I element,” and the derivative element as the “D element.” The PID controller was first placed on the market in 1939 and has remained the most widely used controller in process control until today. An investigation performed in 1989 in Japan indicated that more than 90% of the controllers used in process industries are PID controllers and advanced versions of the PID controller.

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Table of Contents Control Systems Robotics And Automation Vol Ii Pid

1. Understanding the eBook Control Systems Robotics And Automation Vol Ii Pid
 - The Rise of Digital Reading Control Systems Robotics And Automation Vol Ii Pid
 - Advantages of eBooks Over Traditional Books
2. Identifying Control Systems Robotics And Automation Vol Ii Pid
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Control Systems Robotics And Automation Vol Ii Pid
 - User-Friendly Interface
4. Exploring eBook Recommendations from Control Systems Robotics And Automation Vol Ii Pid
 - Personalized Recommendations
 - Control Systems Robotics And Automation Vol Ii Pid User Reviews and Ratings
 - Control Systems Robotics And Automation Vol Ii Pid and Bestseller Lists

5. Accessing Control Systems Robotics And Automation Vol Ii Pid Free and Paid eBooks
 - Control Systems Robotics And Automation Vol Ii Pid Public Domain eBooks
 - Control Systems Robotics And Automation Vol Ii Pid eBook Subscription Services
 - Control Systems Robotics And Automation Vol Ii Pid Budget-Friendly Options
6. Navigating Control Systems Robotics And Automation Vol Ii Pid eBook Formats
 - ePub, PDF, MOBI, and More
 - Control Systems Robotics And Automation Vol Ii Pid Compatibility with Devices
 - Control Systems Robotics And Automation Vol Ii Pid Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Control Systems Robotics And Automation Vol Ii Pid
 - Highlighting and Note-Taking Control Systems Robotics And Automation Vol Ii Pid
 - Interactive Elements Control Systems Robotics And Automation Vol Ii Pid
8. Staying Engaged with Control Systems Robotics And Automation Vol Ii Pid
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Control Systems Robotics And Automation Vol Ii Pid
9. Balancing eBooks and Physical Books Control Systems Robotics And Automation Vol Ii Pid
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Control Systems Robotics And Automation Vol Ii Pid
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Control Systems Robotics And Automation Vol Ii Pid
 - Setting Reading Goals Control Systems Robotics And Automation Vol Ii Pid
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Control Systems Robotics And Automation Vol Ii Pid
 - Fact-Checking eBook Content of Control Systems Robotics And Automation Vol Ii Pid
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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