Practical Design of PID Controllers in MATLAB and Simulink

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Objective

More than 90% of all controllers used in process industries today are PID controllers. It is estimated that a typical paper mill has more than 1000 PID control loops. PID controllers are also widely used in chemical, food, medical, and petrochemical industries. The purpose of this presentation is to highlight important properties of PID controllers; present a simplified approach to PID controller design based on low-order process model approximations; and illustrate the commands and tools available in MATLAB and Simulink for PID controller design.

Outline

Introduction to PID Controllers

Objective: Introduce PID controllers and discuss their important properties.

- What is a PID controller?
- Types of PID controllers: P, PI, PID, etc.
- How and why do PID controllers work?

Low-Order Process Models for PID Design

Objective: Describe the basics of low-order process modeling.

- Introduce first- and second-order process models.
- Discuss dominant behavior of high-order process models.

Practical Design of PID Controllers

Objective: Illustrate a practical approach to PID controller design based on low-order models.

- Designing a PI controller using a first-order process model.
- Designing a PID controller using a second-order process model.
- Designing PI/PID controller for high-order models through dominant pole cancellation.

MATLAB and Simulink Demonstration

Objective: Use MATLAB and Simulink to design and simulate control systems.

- Commands to create process models and PID controllers.
- Open- and closed-loop responses (step response, bode or frequency-domain response).
- Using SISOTOOL in Control System Toolbox for PID design.
- Building PID controllers in Simulink. Discuss some design issues: linearization, operating points.

Presenter Information

Dr. Bora Eryilmaz is the engineering manager of the Control and Estimation Tools group at the MathWorks, Inc. He received the B.S. in mechanical engineering from Bosphorus University, Istanbul, Turkey in 1994, and the M.S. and Ph.D. in mechanical engineering from Northeastern University, Boston, in 1996 and 2000, respectively. He joined the MathWorks, Inc. in 2000, where he worked as a senior software developer in the Controls and Identification group, contributing to the Control System Toolbox and the Simulink Parameter Estimation softwares. He has also taught various controls courses at Northeastern University in the Department of Mechanical Engineering. He is the author of numerous scientific publications in the areas of dynamic systems and controls. His current interests include developing user-friendly software tools for parameter estimation and control system design for the MATLAB and Simulink family of products.