Model Reduction for Control System Design: Communications and Control Engineering

By John Doe

Model Reduction for Control System Design provides a systematic and unified approach to model reduction, with a focus on developing mathematical techniques and computational algorithms. The book covers a wide range of topics, including Hankel norm approximation, balanced truncation, and Krylov subspace methods. It also includes case studies and examples from a variety of applications, such as robotics, chemical processes, and power systems.

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Model reduction is a key technique for controller design. It allows us to reduce the size of a complex model, while still maintaining its essential dynamics. This makes it possible to design controllers that are more efficient and easier to implement.

Model Reduction for Control System Design (Communications and Control Engineering) by Goro Obinata

★★★★★ 5 out of 5

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Print length   : 183 pages

There are a variety of model reduction techniques available. However, the most common techniques are Hankel norm approximation, balanced truncation, and Krylov subspace methods.

Hankel Norm Approximation

Hankel norm approximation is a technique for model reduction that minimizes the Hankel norm of the error between the original model and the reduced model. The Hankel norm is a measure of the energy of the error over all frequencies.

Hankel norm approximation is a powerful technique that can produce very accurate reduced models. However, it can also be computationally expensive.

Balanced Truncation

Balanced truncation is a technique for model reduction that preserves the controllability and observability of the original model. It does this by truncating the model based on the singular values of the Hankel matrix.

Balanced truncation is a less computationally expensive technique than Hankel norm approximation. However, it can sometimes produce less accurate reduced models.

Krylov Subspace Methods

Krylov subspace methods are a class of model reduction techniques that use a Krylov subspace to approximate the original model. Krylov subspaces are a subspace of the state space that is generated by applying a sequence of linear transformations to the original model.

Krylov subspace methods are computationally efficient and can produce accurate reduced models. However, they can be sensitive to the choice of subspace basis.

Case Studies

The book includes a number of case studies that demonstrate the application of model reduction techniques to a variety of real-world problems. These case studies include:

- Design of a controller for a robotic arm

- Control of a chemical process

- Stabilization of a power system

Applications

Model reduction has a wide range of applications in control system design. Some of the most common applications include:

- Controller design

- System identification

- Fault detection and diagnosis

- Optimization

Model Reduction for Control System Design is a comprehensive and authoritative guide to model reduction. It provides a systematic and unified approach to model reduction, with a focus on developing mathematical techniques and computational algorithms. The book covers a wide range of topics, including Hankel norm approximation, balanced truncation, and Krylov subspace methods. It also includes case studies and examples from a variety of applications, such as robotics, chemical processes, and power systems.

Model Reduction for Control System Design is an essential resource for anyone who is interested in learning more about model reduction. It is a valuable reference for researchers, engineers, and students alike.

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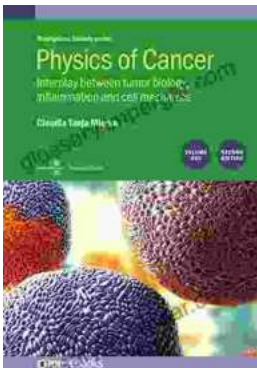|	
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