

Springer Book Proposal

A. Project

Author/Editor Names: Yi Yu, Guo-Ping Liu

Book Title: Control of Renewable Power Systems: A Fully Actuated System Approach

B. Short Book Description

Your book description should motivate potential audiences to read this book. Keep it concise and focused on what makes your book unique. Follow these pointers for an effective description:

- **Subject:** Identify the book's core subject, avoid describing the topic in detail or giving definitions.
- **Importance:** Explain its significance to its target audience.
- **Content Summary:** Offer a brief overview of the book's content.
- **Key Points:** Highlight the most engaging methods, results, or topics.
- **Benefits:** State the main benefits readers will receive.
- **Prerequisites:** Note any required background for comprehension.

Aim for 200-300 words, in 1-3 paragraphs; write in an active, engaging tone; integrate keywords naturally for SEO.

In an era of escalating energy demands and environmental challenges, mastering the complexities of renewable energy power systems is essential. *Control of Renewable Power Systems: A Fully Actuated System Approach* delivers a cutting-edge exploration of innovative modeling and control techniques tailored for the unique characteristics of renewable energy systems. Designed for engineers, researchers, and sustainability advocates, this book addresses critical issues such as low inertia and high variability, offering a roadmap to ensure safe, stable, and efficient operation.

This comprehensive guide introduces the fully actuated system approach, a groundbreaking method that redefines how we tackle the nonlinear dynamics inherent in renewable energy systems. By presenting experimentally validated solutions on hardware microgrids, the book bridges the gap between theory and practice, making it an indispensable resource for professionals aiming to enhance system reliability and control efficiency. Key topics include predictive control for DC and AC systems, learning-based optimization, and resilience strategies against cyber threats, with advanced applications like blockchain integration for secure operations.

Readers will gain actionable insights into modern control strategies, rigorous modeling techniques, and emerging technologies shaping the future of sustainable energy systems. Whether you're developing advanced control technologies or navigating the challenges of modern power systems, this book equips you with the knowledge and tools to lead in the renewable energy revolution.

C. Table of Contents

For 'Authored Book': a detailed ToC with a second or even further hierarchy is preferred.

For 'Edited Volume': a preliminary ToC with first-level hierarchy is sufficient, however, please list the contributors' names and institutional affiliations for each chapter.

a) Please also include the objectives of each chapter and how the chapters interrelate; b) If available, please provide sample chapters that are representative of the book's level and style. If the manuscript is complete, attach the entire PDF (If applicable) for our reference.

Preface

1. Introduction

- This chapter introduces the characteristics and advances in renewable energy power systems, along with the basic theory of the fully actuated systems approach. It sets the stage for understanding the importance of controlling renewable energy power systems and provides an overview of the book's structure, summarizing the content of each chapter to guide readers on how to navigate the material.

1.1 Overview

1.2 Renewable Energy Power Systems and Their Characteristics

1.3 Development Status and Prospects of Renewable Energy Power Systems

1.4 Modeling and Control of Renewable Energy Power Systems

1.5 Introduction to the Basic Theory of Fully Actuated System Methods

References

Part I Secondary Control of Renewable Energy Power Systems

2. Mechanism Models of Renewable Energy Power Systems

- This chapter presents mechanism-based large-signal models for DC, AC, and hybrid renewable energy power systems. The model forms the basis for the design of the fully actuated control, providing the electrical topology and description of the power system.

2.1 Overview

2.2 Models of DC Renewable Energy Power Systems

2.3 Models of AC Renewable Energy Power Systems

2.4 Models of Hybrid Renewable Energy Power Systems

2.5 Conclusion

References

3. Predictive Control of DC Renewable Energy Power Systems

- This chapter introduces secondary distributed predictive control based on its large signal model of DC renewable energy power systems, addressing communication delays in microgrid system and laying foundation for subsequent fully actuated system model-based secondary control.

3.1 Overview

3.2 Problem Formulation

3.3 Predictive Control of DC Renewable Energy Power Systems

3.3.1 Distributed Average Voltage Observer

3.3.2 Distributed Predictive Control of DC Renewable Energy Power Systems

3.4 Experiment Verification

3.5 Conclusion

References

4. Predictive Control of AC Renewable Energy Power Systems

- This chapter introduces secondary distributed predictive control based on its large signal model of AC renewable energy power systems, addressing communication constraints in microgrid system and laying foundation for subsequent fully actuated system model-based secondary control.

4.1 Overview

4.2 Problem Formulation

4.3 Predictive Control of AC Renewable Energy Power Systems

4.3.1 Distributed Average Voltage Observer

4.3.2 Distributed Predictive Control of AC Renewable Energy Power Systems

4.4 Experiment Verification

4.5 Conclusion

References

Part II Fully Actuated Control of Renewable Energy Power Systems

5. Fully Actuated Predictive Control of Renewable Energy Power Systems

- This chapter develops fully actuated models of DC and AC renewable power systems, including large-signal descriptions and state transformations, transitioning from the traditional state space model to fully actuated microgrid system model.

4.1 Overview

4.2 Problem Formulation

4.3 Predictive Control of Renewable Energy Power Systems

4.4 Experiment Verification

4.5 Conclusion

References

6. Distributed Fully Actuated Control of Renewable Energy Power Systems

- This chapter introduces the secondary distributed optimal fully actuated control for renewable energy power systems. It shows that the secondary optimal control can be easily designed based on

the fully actuated system model. This chapter is an in-depth look at the previous chapter, further demonstrating the advantages of designing controllers based on the fully actuated model, and providing a basis for the subsequent chapters to unfold.

5.1 Overview

5.2 Problem Formulation

5.3 Distributed Optimal Fully Actuated Control of Renewable Energy Power Systems

5.4 Experiment Verification

5.5 Conclusion

References

7. Learning-Based Fully Actuated Predictive Control of Renewable Energy Power Systems

- This chapter introduces iterative learning algorithms for fully actuated control, aiming to improve responsiveness and adaptability within renewable energy power systems.

6.1 Overview

6.2 Problem Formulation

6.3 Iterative Learning-Based Fully Actuated Control of Renewable Energy Power Systems

6.4 Experiment Verification

6.5 Conclusion

References

8. Fully Actuated Control of Renewable Energy Power Systems with Disturbances

- Building on the previous chapter, this chapter focuses on the modeling of nonlinear renewable energy power systems and the implementation of fully actuated voltage control, enhancing the robustness and reliability of control strategies.

7.1 Overview

7.2 Problem Formulation

7.3 Fully Actuated Voltage Control for Renewable Energy Power Systems

7.3.1 Fully Actuated Control Under Unknown Parameters in Renewable Energy Power Systems

7.3.2 Fully Actuated Control of Renewable Energy Power Systems with Unknown Loads

7.4 Experiment Verification

7.5 Conclusion

References

Part III Fully Actuated Secure Control of Renewable Energy Power Systems

9. Fully Actuated Resilient Control of Renewable Energy Power Systems

- This chapter addresses potential cybersecurity issues in renewable energy power systems and discusses the advantages of fully actuated resilient control methods in tackling network. In the

following chapter, we will build on the foundational concepts introduced here to present active secondary fully actuated resilient control strategies.

8.1 Overview

8.2 Problem Formulation

8.3 Fully Actuated Resilient Control of Renewable Energy Power Systems

8.4 Experiment Verification

8.5 Conclusion

References

10. Blockchain-Based Fully Actuated Secure Control of Renewable Energy Power Systems

- This chapter explores fully actuated secure control methods using blockchain technology to enhance the resilience of renewable energy power systems against cyberattacks, integrating techniques from previous chapters.

9.1 Overview

9.2 Problem Formulation

9.3 Blockchain-Based Fully Actuated Secure Control of Renewable Energy Power Systems

9.4 Experiment Verification

9.5 Conclusion

References

11. Conclusion

D. Author/Editor Information

1. Details (Authors, Volume Editors)

– Full names, affiliations, mailing addresses (street name and number, city/town, postal code, country), contact details (incl. e-mails and URLs).

Name: Yi Yu

Affiliations: The Hong Kong Polytechnic University

Mailing addresses: Hung Hom, Kowloon, Hong Kong

Email: eeeyi.yu@polyu.edu.hk

URL: <https://ieeexplore.ieee.org/author/37088814501>

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Mailing addresses: No. 1088, Xueyuan Blvd., Nanshan District, Shenzhen, China

Email: liugp@sustech.edu.cn

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2. Outline CVs (Authors, Editors)

– Career notes, lists of related publications, reviews of these, etc. Please simply link to online sources, if available. In the case of edited volumes provide outline CVs of the editors only, not the chapter contributors.

2.1 Curriculum Vitae (Career)

2.1.1 Curriculum Vitae of Dr. Yi Yu

1) Academic qualifications

- Ph.D., School of Electrical and Automation, Wuhan University, China, 2022

2) Previous professional experience

- School of Electrical and Automation, School of Electrical and Automation, Wuhan University (Visiting scholar, 2017-2019)

3) Present academic position

- Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic University (Postdoctoral Fellow, 2022-now)

2.1.2 Curriculum Vitae of Prof. Guo-Ping Liu

1) Academic qualifications

- Ph.D., Center of control system, University of Manchester, UK, 1992

2) Previous professional experience

- 2019-2021: Professor, School of Electrical Engineering and Automation, Wuhan University
- 2010-2019: Professor, School of Astronautics, Harbin Institute of Technology
- 2003-2010: Professor and Head of Research Unit, Faculty of Advanced Technology, University of Glamorgan
- 2000-2003: Senior Lecturer, School of Mechanical, Materials, Manufacturing Engineering and Management, University of Nottingham
- 1996-2000: Principal Engineer and Project Leader, ALSTOM Ltd.
- 1993-1996: Research Fellow, Department of Automatic Control and Systems Engineering, University of Sheffield
- 1992-1993: Postdoctoral Research Assistant, Department of Electronics, University of York
- 1985-1989: Teaching Assistant and Lecturer, Department of Automatic Control Engineering, Central South University of Technology

3) Present academic position

- Professor, 2021-now, School of Automation and Intelligent Manufacturing (AiM), Southern University of Science and Technology, China

2.2 List of related publications

2.2.1 Closely related publications

- [1] Y. Yu, G. -P. Liu, Y. Huang, C. Y. Chung, and Y. -Z. Li, “A Blockchain Consensus Mechanism for Real-Time Regulation of Renewable Energy Power Systems”, *Nature Communications*, Early Access, 2024.

- [2] Y. Yu, G. -P. Liu, Y. Huang, and P. Shi, “Optimal Cooperative Secondary Control for Islanded DC Microgrids via a Fully Actuated Approach”, *IEEE/CAA Journal of Automatica Sinica*, 2024, 11(2): 1-13.
- [3] Y. Yu, G. -P. Liu, Y. Huang, and J. M. Guerrero, “Coordinated Predictive Secondary Control for DC Microgrids Based on Fully Actuated System Approaches”, *IEEE Trans. Smart Grid*, 2024, 15(1): 19-33.
- [4] Y. Yu, G. -P. Liu, Y. Huang, and J. M. Guerrero, “Distributed Learning-Based Secondary Control for Islanded DC MGs: A High-Order Fully Actuated System Approach”, *IEEE Trans. Industrial Electronics*, 2024, 71(3): 2990-3000.
- [5] Y. Yu, G. -P. Liu, Y. Huang, and P. Shi, “Fully Actuated System-Based Control of DC Microgrids Considering Inductive Tie Lines: A Predictive Strategy With Variable Weights”, *IEEE Trans. Industrial Electronics*, Early access, doi: 10.1109/TIE.2024.3426084.
- [6] Y. Huang, G. -P. Liu, Y. Yu, “Constrained Networked Predictive Control for Nonlinear Systems Using a High-Order Fully Actuated System Approach”, *IEEE/CAA Journal of Automatica Sinica*, Early access.
- [7] Y. Yu, G. -P. Liu, Y. Huang, and J. M. Guerrero, “Distributed Data-Driven Secondary Regulation for the Conflict Between Voltage Recovery and Accurate Current Sharing in DC Microgrids”, *IEEE Trans. Power Electronics*, 2023, 38(8): 9617-9634.
- [8] Y. Yu, G. -P. Liu and W. Hu, “Blockchain Protocol-based Secondary Predictive Secure Control for Voltage Restoration and Current Sharing of DC Microgrids”, *IEEE Trans. Smart Grid*, 2023, 14(3): 1763-1776.
- [9] Y. Yu, G. -P. Liu and W. Hu, “Coordinated Distributed Predictive Control for Voltage Regulation of DC Microgrids with Communication Delays and Data Loss”, *IEEE Trans. Smart Grid*, 2023, 14(3): 1708-1722.
- [10] Y. Yu, G. -P. Liu, X. Dai and W. Hu, “Dynamic Coordinated Control for Multiconverter Systems via a Multistep Prediction Scheme”, *IEEE Trans. Industrial Informatics*, 2023, 19(10): 10322-10333.
- [11] Y. Yu, G. -P. Liu, and W. Hu, “Online Learning Based Voltage and Power Regulator for AC Microgrids”, *IEEE Trans. Circuits and Systems II: Express Briefs*, 2020, 68(4): 1318-1322.

2.2.2 Other related publications

- [1] Y. Yu, G. -P. Liu, and W. Hu, “Blockchain Protocol-Based Secondary Predictive Secure Control for Voltage Restoration and Current Sharing of DC Microgrids,” *IEEE Trans. Smart Grid*, 2023, 14(3): 1763-1776.
- [2] Y. Yu, G. -P. Liu, H. Xiao, and W. Hu, “Design of Networked Secure and Real-Time Control Based on Blockchain Techniques,” *IEEE Trans. Industrial Electronics*, 2021, 69(4): 4096-4106.
- [3] Y. Yu, G. -P. Liu, Y. Huang and W. Hu, “Optimal Resilient Tracking Control for Networked Systems with Multi-Channels Under Attacks” , *IEEE Trans. Industrial Electronics*, 2024, 71(3): 3001-3011.
- [4] Y. Yu, G. -P. Liu and W. Hu, “Learning-Based Secure Control for Multichannel Networked Systems Under Smart Attacks” , *IEEE Trans. Industrial Electronics*, 2023, 70(7): 7183-7193.
- [5] Y. Huang, G. -P. Liu, Y. Yu, and W. Hu, “Data-Driven Distributed Predictive Tracking Control for Heterogeneous Nonlinear Multi-Agent Systems With Communication Delays” , *IEEE Trans. Automatic Control*, 2024, 7(69): 4786-4792.
- [6] Y. Yu, G. -P. Liu, and W. Hu, “Security Tracking Control for Discrete-Time Stochastic Systems

Subject to Cyber Attacks” , ISA Transactions, 2022, 127(1): 133-145.

3. About the Author Text

– Please provide a brief biography that highlights the areas of your work, expertise, publication record related to the proposed book’s topic, and any other relevant information such as honors, achievements, etc.

Dr. Yi Yu is a researcher specializing in system modeling and control, with a particular focus on renewable energy power systems. He has contributed to over 20 peer-reviewed journal articles, emphasizing a methodical and analytical approach to addressing engineering challenges. Dr. Yu was recognized with the Excellent Doctoral Dissertation Award from Chinese Association of Automation in 2023. He also served as a Session Chair at the 10th International Conference on Power Electronics Systems and Application (PESA 2024).

Prof. Guo-Ping Liu is a chair professor with the Southern University of Science and Technology, China. He has authored and co-authored ten books and over 400 journal papers on control systems. He served as the General Chair of the 2007 IEEE International Conference on Networking, Sensing and Control, the 2011 International Conference on Intelligent Control and Information Processing, and the 2012 UKACC International Conference on Control. Prof. Liu served as an Editor-in-Chief for the *International Journal of Automation and Computing* from 2004 to 2021. He is a member of the Academy of Europe, and a Fellow of IEEE, IET and CAA.

E. Book Context

1. Type – *Is your book mainly a research monograph, undergraduate or graduate/advanced textbook, professional book, state-of-the-art survey, major reference work (>1000 pages), etc.?*

The book is a research monograph.

2. Competing Titles – *Please provide titles, authors, ISBNs – publisher or Amazon URLs if possible – of competing titles, and a brief comment on how your proposed book compares.*

There are currently no direct competing titles for the prepared book. Fully actuated system approach was proposed in 2020 and 2021 as a general framework for control system analysis and design based on a newly discovered general type of fully actuated models for dynamical systems. There are no books related to the fully actuated system approach in the research and application of renewable power systems.

3. Readers – *Please select from and reorder the following list to match the expected audience share: scientists and researchers; lecturers and tutors; academic and corporate libraries; practitioners and professionals; postgraduates; undergraduates; others (specify).*

And which research areas are they from?

1) Readers: researchers; academic and corporate libraries; practitioners and professionals; postgraduates; undergraduates

2) Research area: control system, modelling and control of renewable energy power system

4. Keywords (5 -20 keywords in order of importance and relevance):

Renewable Energy Control Systems, Fully Actuated System Approaches, Power Systems Modelling, Renewable Energy Management, Sustainable Power Solutions, Microgrid System, Blockchain Technologies

5. Unique Selling Points that indicate the features and benefits (3 points, each point less than 120 characters):

- 1) Unveils advanced control strategies for renewable energy, enhancing system efficiency and reliability.
- 2) Offers actionable insights for implementing fully actuated systems in real-world energy management.
- 3) Explores innovative, fully actuated techniques to optimize the performance of renewable power systems.

F. Manuscript Plan

1. Planned Date of Manuscript Submission:

The planned date of manuscript submission is May 30, 2025.

2. Planned Pages of Manuscript (Standard Springer book format: 155x235mm, with approx. 500 words per page):

The planned pages of manuscript are 210 pages.

3. Open Access option:

Yes.

(i.e. e-book available to anyone for free from SpringerLink, more information: <https://www.springer.com/gp/open-access/books/faqs>)

If interested, please discuss this with your Publishing Editor. This is an extra option that entails a processing fee, where you locate funders to provide payment to cover those costs.

G. Textbook

Not applicable.

H. Sample Content

– Please specify the status of any sample content accompanying this proposal.

The sample chapter was submitted as an attachment to this proposal.

I. Other Notes

– Please provide any further relevant comments or suggestions.

Please reply to Dr. Celine Lanlan Chang, Computer Science (celine.chang@springer.com)