Computer Modelling of Heat and Fluid Flow in Materials Processing: A Comprehensive Guide to Computational Techniques

The Computer Modelling of Heat and Fluid Flow in Materials Processing provides a detailed and comprehensive overview of the fundamental principles and cutting-edge computational techniques used to model heat and fluid flow in materials processing operations. This book is an invaluable resource for researchers, engineers, and graduate students in the fields of materials science, manufacturing, and chemical engineering.

Key Features

- **Comprehensive coverage:** Covers the entire spectrum of heat and fluid flow modeling techniques, from basic principles to advanced computational methods.

- **In-depth analysis:** Provides a thorough examination of the mathematical formulations, numerical algorithms, and physical interpretations of various modeling techniques.

- **Real-world applications:** Demonstrates the practical applications of heat and fluid flow modeling in materials processing, including casting, welding, and additive manufacturing.

- **Cutting-edge techniques:** Explores recent advances in computational fluid dynamics (CFD) and heat transfer modeling, such as meshless methods, particle-based methods, and multiscale modeling.

- **Extensive references:** Includes an extensive bibliography of research papers and books for further exploration.

Target Audience

The Computer Modelling of Heat and Fluid Flow in Materials Processing is primarily intended for:
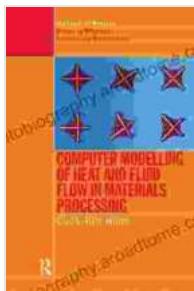
Computer Modelling of Heat and Fluid Flow in Materials Processing (Series in Materials Science and Engineering Book 10)

★★★★☆ 4 out of 5

Language : English
File size : 133311 KB
Print length : 258 pages

- **Researchers:** Provides a comprehensive reference guide for researchers working on computational modeling of heat and fluid flow in materials processing.

- **Engineers:** Offers practical insights and guidance for engineers involved in the design and optimization of materials processing operations.

- **Graduate students:** Serves as an advanced textbook for graduate courses in materials science, manufacturing, and chemical engineering.

Table of Contents

The book is organized into 12 chapters, each covering a specific aspect of heat and fluid flow modeling in materials processing:

1. **:** Provides an overview of the book's scope, objectives, and target audience.

2. **Governing Equations:** Presents the fundamental governing equations for heat and fluid flow in materials processing, including conservation laws and constitutive relations.

3. **Numerical Methods:** Examines various numerical methods used to solve the governing equations, such as finite difference method, finite element method, and boundary element method.

4. **Fluid Flow Modeling:** Covers the principles and applications of fluid flow modeling in materials processing, including laminar and turbulent flows, multiphase flows, and free surface flows.

5. **Heat Transfer Modeling:** Explores the mechanisms and modeling techniques for heat transfer in materials processing, including conduction, convection, and radiation.

6. **Coupled Heat and Fluid Flow Modeling:** Discusses the coupled nature of heat and fluid flow in materials processing and presents techniques for solving coupled problems.

7. **Phase Change Modeling:** Examines the modeling of phase change phenomena, such as solidification, melting, and evaporation, in materials processing.

8. **Microstructure Evolution Modeling:** Describes the modeling of microstructure evolution during materials processing, including grain growth, phase transformations, and recrystallization.

9. **Process Optimization:** Demonstrates how computational models can be used to optimize materials processing operations, such as casting and welding.

10. **Emerging Computational Techniques:** Explores recent advances in computational modeling, such as meshless methods, particle-based methods, and multiscale modeling.

11. **Applications in Materials Processing:** Presents case studies and applications of heat and fluid flow modeling in various materials processing operations.

12. **Future Directions:** Discusses future trends and challenges in the field of computational modeling of heat and fluid flow in materials processing.

Author Credentials

The book is authored by Dr. Y.C. Lam, a renowned researcher and professor in the Department of Mechanical Engineering at the University of Birmingham, UK. Dr. Lam has extensive expertise in computational modeling of materials processing, fluid dynamics, and heat transfer. He has published over 200 journal papers and conference proceedings and is the recipient of numerous awards and recognitions for his research contributions.

The Computer Modelling of Heat and Fluid Flow in Materials Processing is an indispensable resource for researchers, engineers, and graduate students involved in the modeling and optimization of materials processing operations. It provides a comprehensive overview of the fundamental principles, computational techniques, and real-world applications of heat and fluid flow modeling in materials processing. This book is a valuable

addition to the libraries of professionals and academicians working in this field.

Additional Information

The book is available in hardcover, paperback, and e-book formats from Taylor & Francis. For more information, please visit the following link:
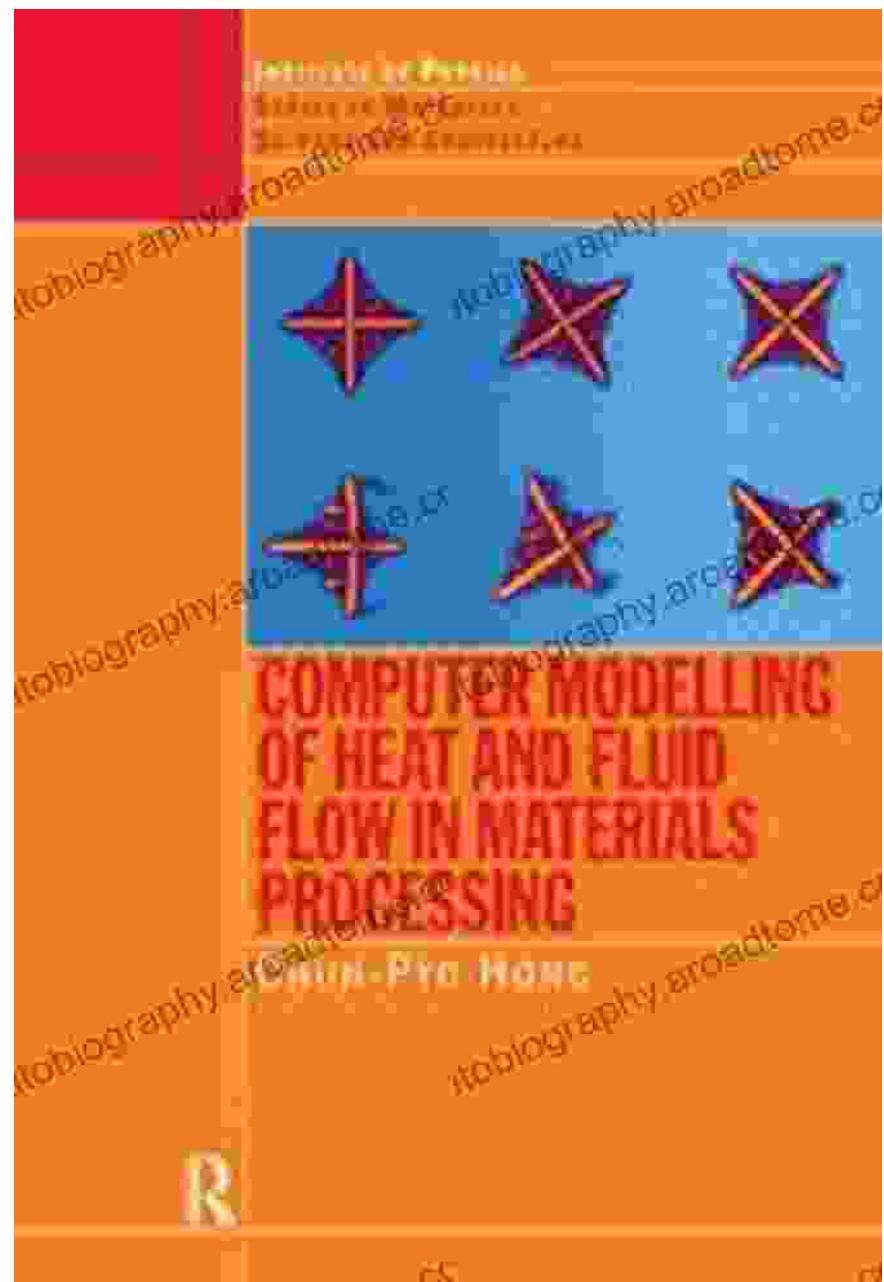
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Chun-Pyo Hong

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Thermocouple 1

Thermocouple 2
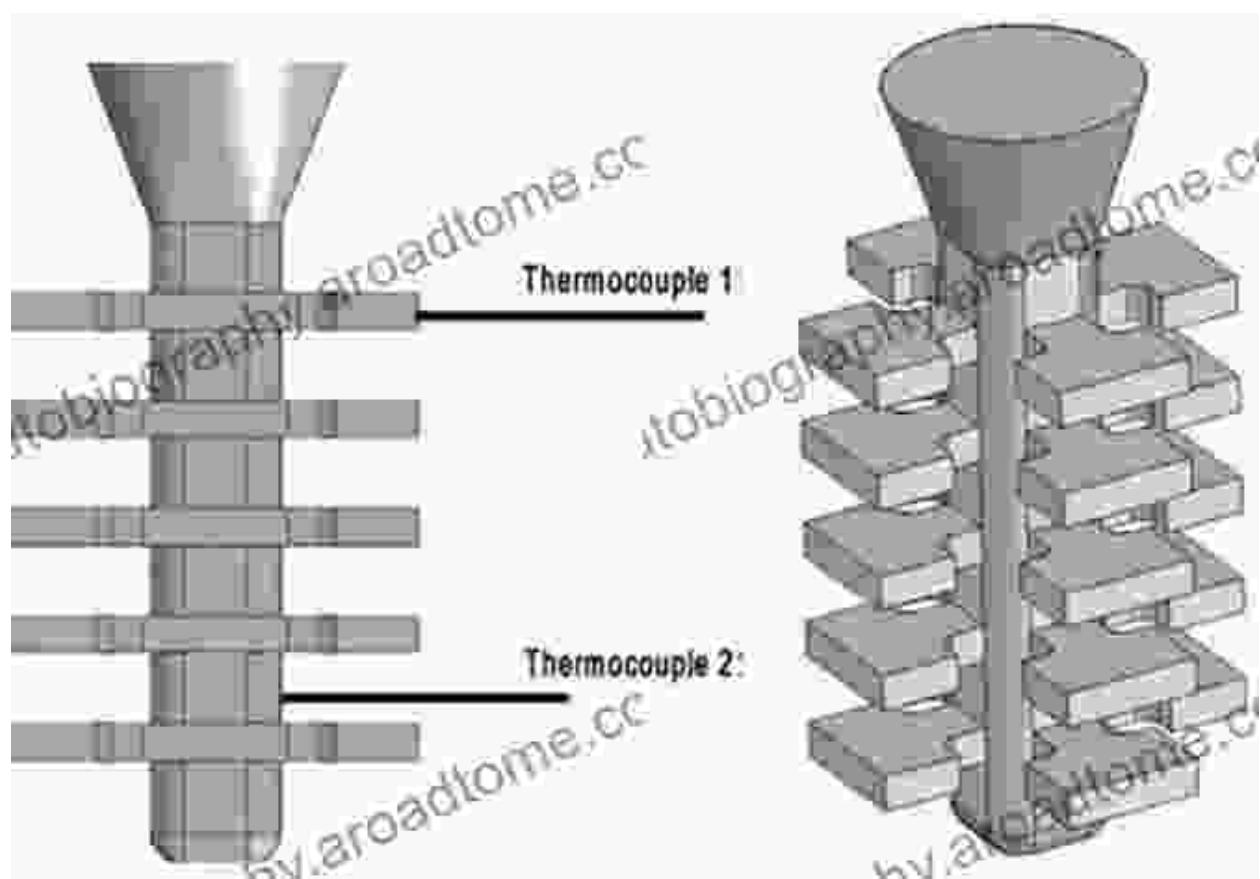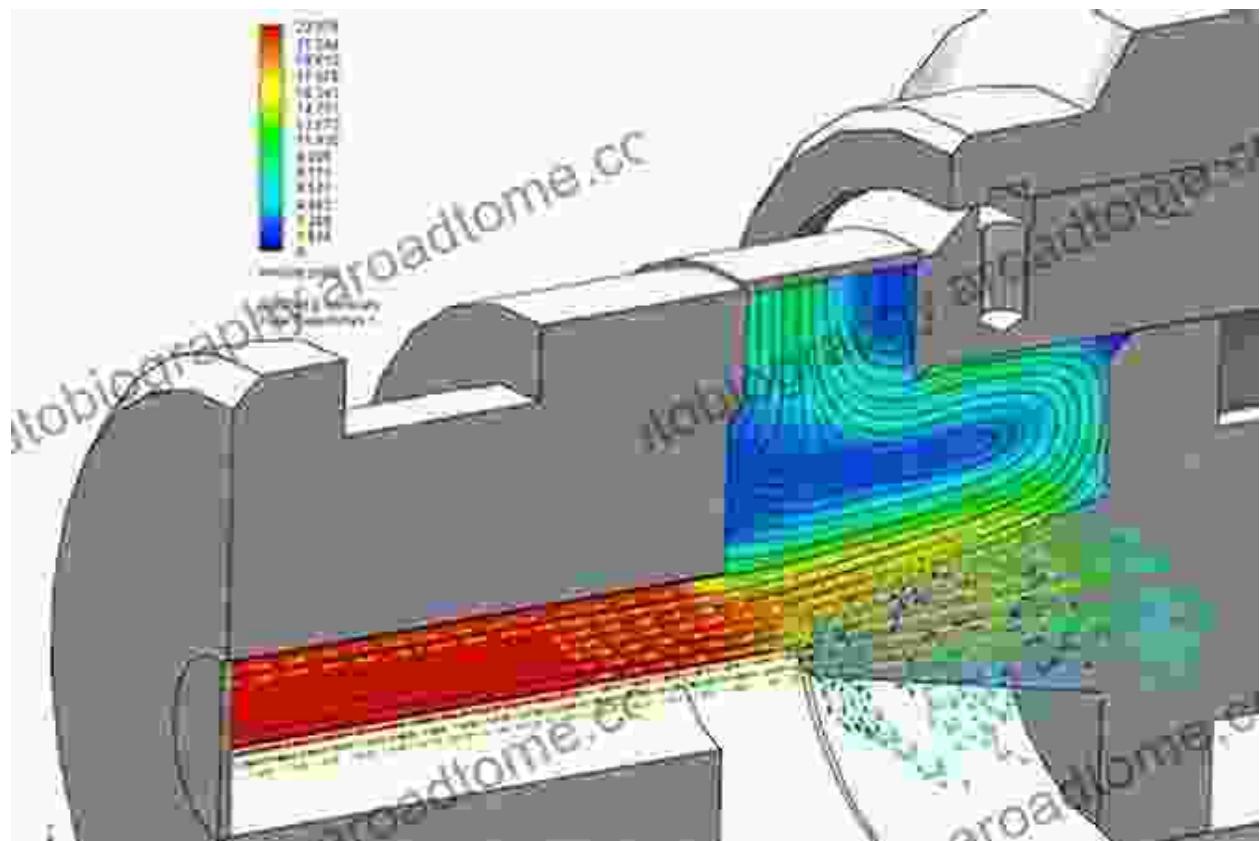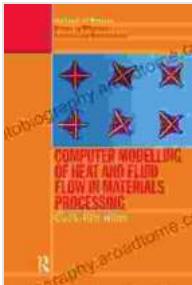
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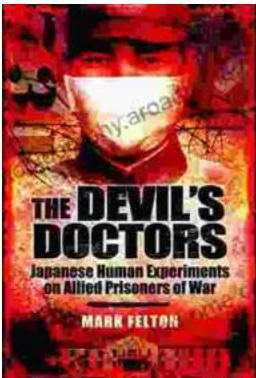
The Devil Doctors: A Heart-wrenching Tale of Betrayal and Resilience

The Devil Doctors is a gripping novel that explores the dark side of the medical profession. It follows the story of a young doctor who...
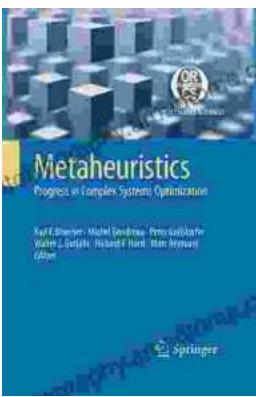
Progress In Complex Systems Optimization Operations Research Computer Science

This book presents recent research on complex systems optimization, operations research, and computer science. Complex systems are systems that...