



Flexible Robotics: Applications to Multiscale Manipulations (ISTE)

Mathieu Grossard

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The objective of this book is to provide those interested in the field of flexible robotics with an overview of several scientific and technological advances in the practical field of robotic manipulation. The different chapters examine various stages that involve a number of robotic devices, particularly those designed for manipulation tasks characterized by mechanical flexibility. Chapter 1 deals with the general context surrounding the design of functionally integrated microgripping systems. Chapter 2 focuses on the dual notations of modal commandability and observability, which play a significant role in the control authority of vibratory modes that are significant for control issues. Chapter 3 presents different modeling tools that allow the simultaneous use of energy and system structuring notations. Chapter 4 discusses two sensorless methods that could be used for manipulation in confined or congested environments. Chapter 5 analyzes several appropriate approaches for responding to the specific needs required by versatile prehension tasks and dexterous manipulation. After a classification of compliant tactile sensors focusing on dexterous manipulation, Chapter 6 discusses the development of a complying triaxial force sensor based on piezoresistive technology. Chapter 7 deals with the constraints imposed by submicrometric precision in robotic manipulation. Chapter 8 presents the essential stages of the modeling, identification and analysis of control laws in the context of serial manipulator robots with flexible articulations. Chapter 9 provides an overview of models for deformable body manipulators. Finally, Chapter 10 presents a set of contributions that have been made with regard to the development of methodologies for identification and control of flexible manipulators based on experimental data.

Contents

1. Design of Integrated Flexible Structures for Micromanipulation, Mathieu Grossard, Mehdi Boukallel, Stéphane Régnier and Nicolas Chaillet.
2. Flexible Structures' Representation and Notable Properties in Control, Mathieu Grossard, Arnaud Hubert, Stéphane Régnier and Nicolas Chaillet.
3. Structured Energy Approach for the Modeling of Flexible Structures, Nandish R. Calchand, Arnaud Hubert, Yann Le Gorrec and Hector Ramirez Estay.
4. Open-Loop Control Approaches to Compliant Micromanipulators, Yassine Haddab, Vincent Chalvet and Micky Rakotondrabe.
5. Mechanical Flexibility and the Design of Versatile and Dexterous Grippers, Javier Martin Amezaga and Mathieu Grossard.
6. Flexible Tactile Sensors for Multidigital Dexterous In-hand Manipulation, Mehdi Boukallel, Hanna Yousef, Christelle Godin and Caroline Coutier.
7. Flexures for High-Precision Manipulation Robots, Reymond Clavel, Simon Henein and Murielle Richard.
8. Modeling and Motion Control of Serial Robots with Flexible Joints, Maria Makarov and Mathieu Grossard.
9. Dynamic Modeling of Deformable Manipulators, Frédéric Boyer and Ayman Belkhiri.
10. Robust Control of Robotic Manipulators with Structural Flexibilities, Housseem Halalchi, Loïc Cuvillon, Guillaume Mercère and Edouard Laroche.

About the Authors

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