

Preface

Robotics and Mechatronics successfully fuse (but are not limited to) mechanics, electrical, electronics, sensors and perception, informatics and intelligent systems, control systems and advanced modeling, optics, smart materials, actuators, systems engineering, artificial intelligence, intelligent computer control, precision engineering, virtual modeling, etc. into a unified framework that enhances the design of products and manufacturing processes.

The synergy in engineering creative design and development enables a higher level of interdisciplinary research that leads to high quality performance, smart and high functionality, precision, robustness, power efficiency, application flexibility and modularity, improved quality and reliability, enhanced adaptability, intelligence, maintainability, better spatial integration of subsystems (embodied systems), miniaturization, embedded lifecycle design, sustainable development, and cost effective approach. The adoption of such a synergized inter- or trans-disciplinary approach to engineering design implies a greater understanding of the design process.

While the technologies are advancing in different directions and there continues to be progressive evolution of interdisciplinary development in terms of research, education, and product development, there is continuous and growing interest in the fields of robotics and mechatronics.

This book aims to capture the state-of-art research developments in the subject area of engineering creative design in robotics and mechatronics, and to provide relevant theoretical knowledge in the field, technological evolution, and new findings. This book includes 17 chapters, divided into four sections.

The first section covers chapters 1-6, which present robotics-mechatronics and biomimetics as an interdisciplinary engineering science. It covers topics on: “Silicon Micro-Robot with Neural Networks”; “Gait Transition Control of a Biped Robot from Quadrupedal to Bipedal Locomotion Based on Central Pattern Generator, Phase Resetting, and Kinematic Synergy”; “Design for Information Processing in Living Neuronal Networks”; “Novel Swimming Mechanism for a Robotic Fish”; “Efficient Evolution of Modular Robot Control via Genetic Programming”; and “Awareness-Based Recommendation: Toward the Human Adaptive and Friendly Interactive Learning System.”

The second section includes chapters 7-10. It introduces research topics related to advancement in robotics with main focus on control and stability, visual servoing, inferring intention, and sensors.

The third section covers chapters 11-13. It focuses on teleoperation and associated research issues in different applications, such as: “Development and Simulation of an Adaptive Control System for the Teleoperation of Medical Robots”; “Design and Development of Teleoperation for Forest Machines: An Overview”; “Time Delay and Uncertainty Compensation: State-of-Art and with Case Studies.”

The fourth section consists of chapters 14-17. These chapters discuss different topics related to “Modeling and Simulation Approaches for Gas Turbine System Optimization”; “Robotic CAM System Available for Both CL and NC Data”; “Robotic Grippers, Grasping, and Grasp Planning”; and “Cyber Infra Product Concept and its Prototyping Strategies.”

Creative engineering design in robotics and mechatronics helps to prepare graduate students, engineers, and scientists who are looking to develop innovative, intelligent, and bioinspired ideas for autonomous and smart interdisciplinary products and systems to meet today’s most pressing challenges.

This book is aimed for senior students in mechatronics and relevant fields, engineers, and scientists, and also for graduate students, robotics engineers and researchers, and practicing engineers who wish to enhance and broaden their knowledge and expertise on the fundamentals, practices, technologies, applications, and the evolution of robotics and mechatronics.

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