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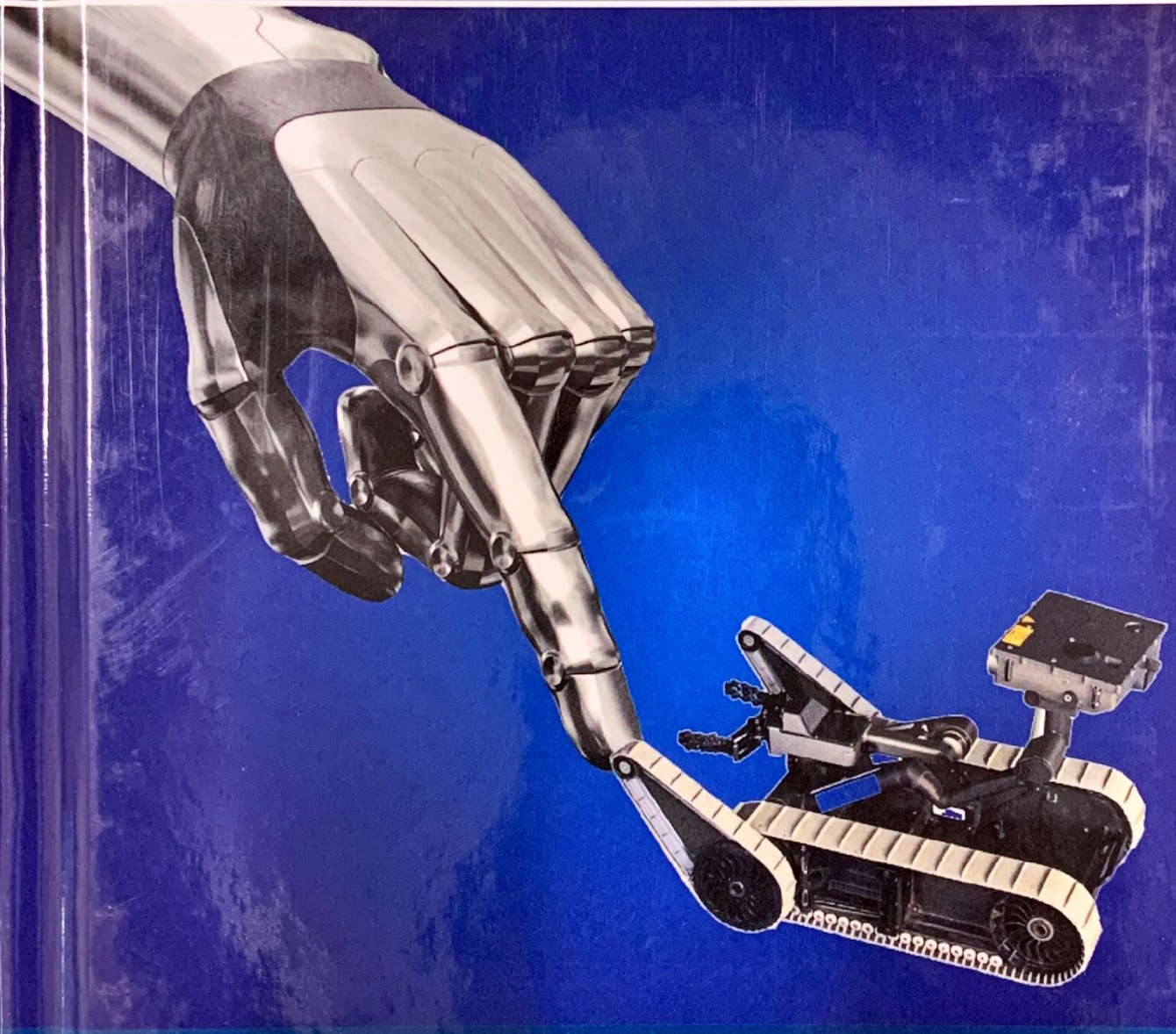

INTRODUCTION TO MOBILE ROBOT CONTROL

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Introduction to Mobile Robot Control

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Contents

Preface

Robotics has been a dominant contributor to the development of the human society over the years. It is a field that needs the synergy of a variety of scientific areas such as mechanical engineering, electrical-electronic engineering, control engineering, computer engineering, sensor engineering, and others. Robots and other automated machines have to live together with people. In this symbiosis, human needs and preferences should be predominantly respected, incorporated, and implemented. To this end, modern robots, especially wheeled or legged mobile robots, incorporate and realize in a purposeful and profitable way the *perception–action cycle* principle borrowed from biological systems and human cognitive and adaptation capabilities.

The objective of this book is to present in a cohesive way a set of fundamental conceptual and methodological elements, developed over the years for nonholonomic and omnidirectional wheeled mobile robots. The core of the book (Chapters 5 through 10) is devoted to the analysis and design of several mobile robot controllers that include basic Lyapunov-based controllers, invariant manifold–based controllers, affine model–based controllers, model reference adaptive controllers, sliding-mode and Lyapunov-based robust controllers, neural controllers, fuzzy-logic controllers, vision-based controllers, and mobile manipulator controllers. The topics of mobile robot drives, kinematics, dynamics, and sensing are covered in the first four chapters. The topics of path planning, motion planning, task planning, localization, and mapping are covered in Chapters 11 and 12, including most fundamental concepts and techniques at a detail compatible with the purpose and size of the book. Chapter 13 provides a selection of experimental results obtained by many of the methods studied in this book. These results were drawn from the research literature and include some of the author's results. Chapter 14 provides a conceptual overview of some generic systemic and software architectures developed for implementing integrated intelligent control of mobile robots. Finally, Chapter 15 provides a tour to the applications of mobile robots in the factory and society at an encyclopedic level.

For the convenience of the reader, the first section of each chapter involves the required mathematical, mechanics, control, and fixed-robot background concepts that are used in the chapter. The book is actually complementary to most books in the field, in the sense that it provides a solid model-based analysis and design of a large repertory of mobile robot control schemes, not covered in other books.

This book is suitable for senior undergraduate and graduate instructional courses on general and mobile robotics. It can also be used as an introductory reference

book by researchers and practitioners in the field that need a consolidated methodological source for their work.

I am grateful to all publishers and authors for granting their permission to include in the book the requested illustrations and experimental plots.

Spyros. G. Tzafestas
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