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Jadran Lenarčič · Jean-Pierre Merlet  
Editors

# Advances in Robot Kinematics 2016

 Springer

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# Foreword

Robots! Robots on Mars and in oceans, in hospitals and homes, in factories and schools; robots fighting fires, making goods and products, saving time and lives. Robots today are making a considerable impact from industrial manufacturing to health care, transportation, and exploration of the deep space and sea. Tomorrow, robots will become pervasive and touch upon many aspects of modern life.

The *Springer Tracts in Advanced Robotics (STAR)* was launched in 2002 with the goal of bringing to the research community the latest advances in the robotics field based on their significance and quality. During the latest fifteen years, the STAR series has featured publication of both monographs and edited collections. Among the latter, the proceedings of thematic symposia devoted to excellence in robotics research, such as ISRR, ISER, FSR, and WAFR, have been regularly included in STAR.

The expansion of our field as well as the emergence of new research areas has motivated us to enlarge the pool of proceedings in the STAR series in the past few years. This has ultimately led to launching a sister series in parallel with STAR. The *Springer Proceedings in Advanced Robotics (SPAR)* is dedicated to the timely dissemination of the latest research results presented in selected symposia and workshops.

This volume of the SPAR series brings the proceedings of the fifteenth edition of ARK on Advances in Robot Kinematics, whose proceedings have been previously published by Kluwer and Springer since 1991. This edition took place in Grasse, France, from June 27 to June 30, 2016. The volume edited by Jadran Lenarčič and Jean-Pierre Merlet contains 46 scientific contributions, revised and extended after the meeting. This collection focuses on mechanism and kinematics with special emphasis on parallel robots, control, and singularities.

From its excellent technical program to its warm social interaction, ARK culminates with this unique reference on the current developments and new advances in robot kinematics—a genuine tribute to its contributors and organizers!

Naples, Italy  
Stanford, CA, USA  
March 2017

Bruno Siciliano  
Oussama Khatib  
SPAR Editor

# Preface

Kinematics, the motion of mechanisms, is one of the most fundamental aspects of robot design, analysis, and control, but it is also relevant to other scientific domains, such as biomechanics, molecular biology, and others. This series of books on *Advances in Robot Kinematics*, which reports the latest achievements in the field, has a long history, as the first symposium was organized in 1988, and the first book was published by Springer in 1991. Since then, a new issue has been published every two years. Each book is linked to a single-track symposium in which the participants exchange their results and opinions in a meeting that brings together the world's best researchers and scientists as well as young students. Since 1992, these symposia have come under the patronage of the International Federation for the Promotion of Machine Science (IFToMM).

In 2016, the symposium related to this book was organized by the French National Research Institute in Computer Science and Control Theory (INRIA) in Grasse, France. We are grateful to the authors for their contributions and to the large team of reviewers for their critical and insightful recommendations. The papers in this book show that robot kinematics is an exciting domain with an enormous number of research challenges that go well beyond the field of robotics. We are also indebted to the members of the HEP-HAISTOS team of INRIA for their help in organizing the symposium. The articles from this symposium were first published in a green open-access archive to favor the free dissemination of the results. We are grateful to Y. Papegay for putting the edition together.

The current book is the 13th in the series of Springer (and Kluwer) and is the result of a peer-review process intended to select the newest and most original achievements in this field. The book was published after the conference. This was unusual for the series from the symposia *Advances in Robot Kinematics*, because the books are typically released before the conference. However, this circumstance allowed the authors to have their manuscripts further improved and to take into account the opinions and constructive criticisms of the conference participants. Some authors even made re-calculations and produced new and more valuable results.

First and foremost, we are grateful to the authors who participated in this project with all their enthusiasm and commitment. We are grateful to Springer, to the whole team, but especially to Nathalie Jacobs and Cynthia Feenestra, who have made this publication possible. Above all, we are grateful to our younger colleague Tadej Petrič, Ph.D., whose assistance was crucial in the technical production of the book. Without him, things would not have taken place as efficiently and rapidly.

We hope that our book will again reach the shelves of scholars, researchers, and students around the world who are attracted to the unique field of robot kinematics.

Ljubljana, Slovenia  
September 2016

Jadran Lenarčič  
Jean-Pierre Merlet



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