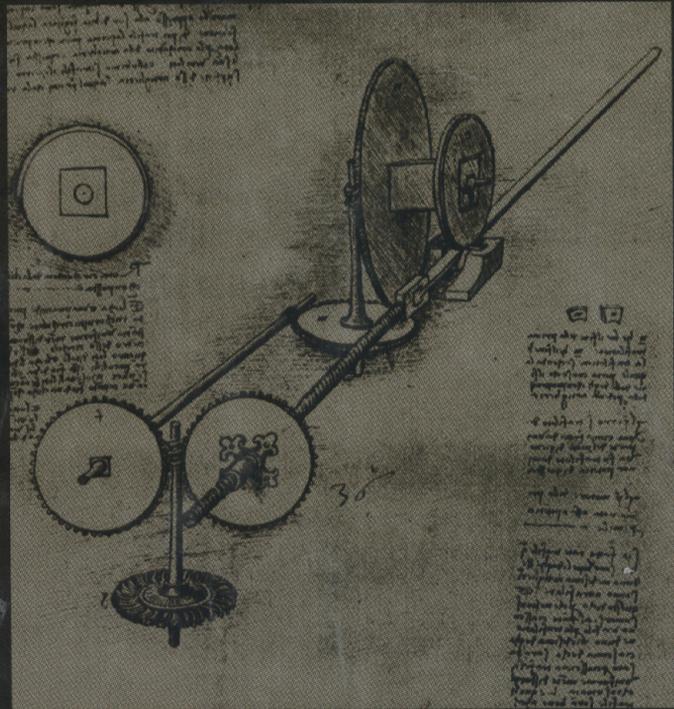


International Summer School on

# Modelling and Control of Mechanisms and Robots

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Editors

Claudio Melchiorri  
Antonio Tornambè

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# Modelling and Control of Mechanisms and Robots

*Bertinoro, Italy*

*22 – 26 July 1996*

Editors

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**World Scientific**

*Singapore • New Jersey • London • Hong Kong*

*Published by*

World Scientific Publishing Co. Pte. Ltd.

P O Box 128, Farrer Road, Singapore 912805

USA office: Suite 1B, 1060 Main Street, River Edge, NJ 07661

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

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## **MODELLING AND CONTROL OF MECHANISMS AND ROBOTS**

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ISBN 981-02-2724-8

This book is printed on acid-free paper.

Printed in Singapore by Uto-Print

## Preface

This book contains the lecture notes of the International Summer School on "Modelling and Control of Mechanisms and Robots", hosted by the Università di Bologna in its Residential Center in Bertinoro, Italy, on July 22 - 26, 1996.

Robotics is a very active multidisciplinary area, in which significant contributions from a number of different methodological areas can be recognized: computer science, mechanics, control, materials, advanced technology, and so on. Moreover, it has to be considered also that during recent years each of these areas witnessed very rapid and important developments, and that robotics is now used in applications not only strictly related to industrial or productive environments. For these reasons, it was necessary to make some important choices in the selection of the material to be presented in the School.

From this point of view, the goals expected from these lecture notes are to illustrate in an advanced form some general tools for the solution of the modelling and control problems of complex mechanical systems, such as robots, and moreover to give an overview on some technological aspects related to the developments and applications of these devices. Therefore, besides classical topics such as: modelling of mechanical systems, kinematics of robots, control of hamiltonian systems, the contact problem in classical mechanics, other fields more related to applications have been considered: elastic and flexible robots, telemanipulation, force control, technologies and methodologies for motion control. In any case, the common denominator for the presentation of these topics has to be found in the control area.

It is from this aspect, in fact, that the topics are illustrated, trying in several cases to collect and rationalize in a compact and didactic form a number of important contributions presented in technical articles at international conferences or journals.

As scientific coordinators, we want to thank the other authors of the notes, and teachers of the Summer School, for the outstanding work, the motivations, and the efforts for the rationalization of the material: Alessandro Astolfi (UK), Bernard Brogliato (F), Joris De Schutter (B), Andrés Kecskeméthy (G), Bernhard Maschke (F), Alberto Tonielli (I). The cooperation of Alessandro Eusebi (I) for the part on telemanipulation is also gratefully recognised. Moreover, the help and kind availability of Laura Menini (I) and Luca Zaccarian (I) for the final editorial work is acknowledged.

The following institutions have contributed in different manners to this initiative: DEIS, Dipartimento di Elettronica Informatica e Sistemistica (Università di Bologna), DMA, Dipartimento di Meccanica e Automatica (Terza Università di Roma), CIRA, Centro Interuniversitario di Ricerche in Automatica.

Finally, the contribution of ERNET, the European Robotics Network coordinated by Prof. Claudio Bonivento (I) and financed by the EU Commission, has to be particularly acknowledged. It is due to this initiative that almost thirty European research laboratories active in the robotics area had the opportunity of better knowing each other and jointly developing a number of significant research projects during the three-year long programme (1994 - 1996). The School has been conceived and organised with the same spirit of ERNET: exchanging expertise, knowledge and willingness among European research people, with the focus on robotics.

Claudio Melchiorri  
Antonio Tornambè

April 1996

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