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Volume 115

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Gravity Compensation in Robotics

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ISSN 2211-0984 ISSN 2211-0992 (electronic)
Mechanisms and Machine Science
ISBN 978-3-030-95749-0 ISBN 978-3-030-95750-6 (eBook)
https://doi.org/10.1007/978-3-030-95750-6

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The actuator power required to resist joint torque caused by the weight of robot links can be a significant problem. Gravity compensation is a well-known technique in robot design to achieve equilibrium throughout the range of motion and as a result to reduce the loads on the actuator. Thus, gravity compensation is beneficial, by which a robotic system can be operated with relatively small actuators generating less torque. Therefore, it is desirable and commonly implemented in many situations. Nature of the forces that must compensate gravity and its emplacement in the robotic systems may be diverse: elastic spring forces, counterweights, pneumatic or hydraulic cylinders, electromagnetic forces, etc. The compensation systems can be mounted on the links of the initial robotic structures or on the auxiliary linkage connected with them.

This work presents new research results in the field of gravity compensation in robotic systems. It includes the research results obtained in France, Australia, Russia, Korea, Belgium, Armenia and Italia. Various problems were considered: gravity compensation of planar articulated robotic manipulators; the stiffness modeling of manipulators with gravity compensators; the multi-degree-of-freedom counterbalancing; the design of actuators with partial gravity compensation; a cable-driven robotic suit with gravity compensation for load carriage; various compensation systems for medical cobots and assistive devices; gravity balancing of parallel robots. The book includes both theoretical and experimental research results.

The editor thanks the authors who have contributed with various and interesting research results on several issues of gravity compensation. He hopes that the present book will be useful to the readers and it will expand knowledge in the field of robot design.

Rennes, France
December 2021

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