

Advances of Italian Machine Design

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Received: 9 September 2019; Accepted: 9 September 2019; Published: 11 September 2019

This Special Issue is aimed to promote and circulate recent developments and achievements in the field of Mechanism and Machine Science coming from the Italian community with international collaborations and ranging from theoretical contributions to experimental and practical applications.

It contains selected contributions that were accepted for presentation at the Second International Conference of IFToMM Italy, IFIT2018, that has been held in Cassino on 29 and 30 November 2018 [1]. This IFIT conference is the second event of a series that was established in 2016 by IFToMM Italy in Vicenza. IFIT was established to bring together researchers, industry professionals and students, from the Italian and the international community in an intimate, collegial and stimulating environment.

IFToMM Italy is one of the founding member organizations of IFToMM, the International Federation for the Promotion of Mechanism and Machine Sciences in 1969. Since then, the member organization IFToMM Italy has been active with contributions at national and international levels, and in 2014 IFToMM Italy was legally established as the Italian IFToMM society.

This Special Issue includes papers belonging to a broad range of disciplines, such as the history of MMS (Mechanism and Machine Science), kinematics of mechanisms, transmissions, vehicle dynamics, transportation machinery, bearings, vibrations, design of robots, grasping, exoskeleton designs, medical devices and service systems. These contributions have been selected from among the 57 papers that were presented at IFIT 2018 conference [1] to have extended revised versions of the presented works. Most of them are those granted award recognition in one of the three IFToMM categories of research, applications, and student. These papers were evaluated again with a blind peer-review process to confirm the high quality of the works.

Three hand exoskeletons versions are presented in paper [2], looking at the mechanical design and control for a compact and lightweight solution that has been tested in a real-use scenario in the rehabilitation and assistance fields. Paper [3] presents an innovative system of propulsion for wheelchairs with details inspired by a rowing gesture, with possible application in everyday life and sport wheelchairs for speed races. In paper [4], the mechanical architecture of an old water mill is analyzed by means of few typical examples of an old water mill of the Piemonte region, in the northwest of Italy, looking at the functional details of various mechanisms for restoring them from the perspective of a renewed high quality production, or reconverting them in mini-plants for the production of electricity. Paper [5] discusses an experimental investigation on magneto-rheological elastomers with the aim of adopting these materials as vibration isolators. Paper [6] describes the design of Rene Artificiale Portatile (artificial portable kidney), a novel wearable and portable device for extracorporeal blood ultrafiltration, capable of providing remote treatment of fluid overload in patients with kidney diseases and/or congestive heart failure. Paper [7] presents a semi-automated design algorithm for computing straight bevel gear involute profiles based on the Tredgold approximation method. A specific case study of application of design results is discussed referring to the profiles of two straight bevel gears in a biomedical application for a new laparoscopic robotic system. Paper [8] presents finger designs consisting of a body with a flexible central rod and three longitudinally positioned shape memory alloy wires. This paper introduces a mathematical model for the design and discusses results of experimental tests on three prototypes different materials.

Paper [9] deals with non-linear effects in tilting pad journal bearings with test results of an experimental identification procedure. Paper [10] proposes a new index for a precise calculation of a manipulator's stiffness isotropy with a numerical validation through an evaluation of an R-CUBE manipulator design. Paper [11] presents an experimental characterization of a two-stage planetary gearbox as function of the attached load and the internal friction forces between gears. Paper [12] deals with the use of cost-effective flex and polyvinylidene fluoride strain sensors to estimate some dynamic tire features in free-rolling and real working conditions, with a solution combining a microcontroller-based sensing with a wireless data transmission system. Paper [13] analyzes the oscillation of a solid body with rolling bearers through a model of highly nonlinear differential equations to design a vibro-protected solution.

We would like to thank the members of the Scientific Committees for strong support for the success of IFIT 2018:

Alessandro Gasparetto (University of Udine) Chair
 Nicola Pio Belfiore (University of Roma)
 Massimo Callegari (Polytechnical University of Marche)
 Roberto Caracciolo (University of Padova)
 Giuseppe Carbone (University of Calabria)
 Marco Ceccarelli (University of Rome Tor Vergata)
 Enrico Ciulli (University of Pisa)
 Raffaele di Gregorio (University of Ferrara)
 Pietro Fanghella (University of Genova)
 Andrea Manuello Bertetto (Politecnico di Torino)
 Arcangelo Messina (University of Salento)
 Domenico Mundo (University of Calabria)
 Vincenzo Niola (University of Napoli)
 Paolo Pennacchi (Politecnico di Milano)
 Giuseppe Quaglia (Politecnico di Torino)
 Rosario Sinatra (University of Catania)
 Alberto Trevisani (University of Padova)

The guest editors of this Special Issue thank the authors and reviewers for their efforts and time spent in the valuable scientific contributions and useful feedbacks that have confirmed the high scientific quality of the IFIT 2018 papers.

Conflicts of Interest: The authors declare no conflict of interest.

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