




Advances of Machine Design in Italy 2022

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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 Fourth International Conference of IFToMM Italy, IFIT 2022, that has been held in Naples on 7–9 September 2022 [1]. This IFIT2022 conference is the fourth event of a series that was started in 2016 by IFToMM Italy in Vicenza, and continued with IFIT 2018 in Cassino, and with IFIT 2022 in Naples but held online. The IFIT conferences were established to bring together researchers, industry professionals and students, from the Italian community with international participation 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 Science, which was founded in 1969. Since then, the member organization IFToMM Italy has been active with contributions at national and international levels. In 2014, IFToMM Italy was legally established as the Italian IFToMM society with research and development activity in Mechanism and Machine Science (MMS).

This Special Issue includes papers belonging to a broad range of disciplines in MMS, such as collaborative robotics, vibration analysis, rotor dynamics, gear design, control of vehicles, design of parallel mechanisms, tribology, lubrication, UAVs, mobile manipulators for agricultural applications, kinematics and dynamics of mechanisms, history of mechanisms.

These contributions have been selected from among the 105 papers that were presented at IFIT 2022 conference [1]. Authors have been invited to contribute extended revised versions of the presented conference works. Contributions have been mostly selected among those receiving 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. In particular, paper [2] presents an historical analysis of developments for the creation and usage of models of mechanisms in academic teaching fields. Manuscript [3] is a review of methodologies for the analysis and synthesis of planar mechanisms developed at the Laboratory of Mechatronics and Virtual Prototyping of the University of Ferrara. In [4], the kinematic model and a motion planning pipeline for a mobile manipulator specifically designed for precision agriculture applications, such as crop sampling and monitoring, formed by a novel articulated mobile base and a commercial collaborative manipulator with seven degrees of freedom, is presented. Paper [5] investigates payload solutions for medium and small package delivery (up to 5 kg) with a medium-sized UAV. From this analysis, a prototype for an industrialized package is obtained. A relevant tribology problem is investigated in [6], namely, a methodology for estimating the coefficient of friction with a semi-empirical formulation is presented so that its results are employed to analyze mechanical efficiency losses in a hypoid gearset. A design of a planar parallel mechanism installed on a fast-operating automatic machine is discussed



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in [7], where the mechanism design is optimized in order to reduce the observed vibrations. An advanced methodology, such as multi-objective design optimization, is employed in [8] to efficiently and reliably achieve an optimal lightweight gear design. Paper [9] looks at the squeeze film dampers (SFDs), i.e., components used in many industrial applications, ranging from turbochargers to jet engines. A numerical model based on the Reynolds equation, discretized with the finite difference method, is proposed, and validated by means of experimental tests. The conceptualization and implementation of a versatile and modular unmanned ground vehicle prototype, aimed at testing and assessing new motion planning and control algorithms for different Precision Agriculture applications, is presented in [10]. Manuscript [11] describes a model-based formulation to analytically evaluate the load transfer dynamics of a vehicle and its variation due to the presence of road perturbations. Paper [12] deals with combined experimental and statistical approaches to evaluate the vibrational behavior of a gas micro-turbine supplied with different pure fuels and admixed with rapeseed oils. In [13], some case studies are presented and discussed concerning tools and methodologies for Human–robot collaboration that are developed at the I-Lab laboratory of Università Politecnica delle Marche (Ancona, Italy). In [14], the dynamic sub structuring technique is employed to predict the vibrational behavior of a three-point linkage, in order to determine the frequency response functions, the natural frequencies and the mode shapes of the mechanism in a wide range of configurations. Paper [15] presents the design of a novel feeding device for industrial applications that is composed of a rotary distributor and a four-bar linkage mechanism. The mechanism is designed as result of a specific functional synthesis and the movement of the conveyor blades is driven by the kinematics of the four-bar linkage with a fairly simple control system. In the paper [16], a survey is presented on strategies that were proposed in the last few years to tackle contact mechanics problems involving rough interfaces. Attention is focused on Boundary Element Methods capable of solving the contact with great accuracy and with a proper computational efficiency. Particular attention is addressed to non-linearly elastic constitutive relations and linearly viscoelastic rheology with important practical implications in all the systems, such as, for example, in vibration isolators, dynamic seals, pick and place devices.

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

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