FOREWORD

Special Issue on *Flexure Hinges and Flexure-Hinge Mechanisms*

Flexure (or flexible) hinges have long been incorporated in mechanisms as flexible joints enabling transmission of mechanical motion in a large spectrum of engineering applications where precision, accuracy and quasi-continuous output are needed.

This special issue gathers a few papers by researchers with a continued interest in exploring, pioneering and expanding the boundaries of flexure-hinge device analysis and design. The issue is formally divided into two sections: the first part comprises contributions on flexure hinges and the second part is dedicated to flexure-hinge mechanisms. The articles span a relatively wide domain in terms of topical coverage, modeling methodology and applications.

Almost 60 years ago, Jerry Paros co-authored a seminal paper that introduced the circular flexure hinge together with its exact and approximate compliance equations. In the article included here, Dr. Paros of Paroscientific, Inc. & Quartz Seismic Sensors, Inc. offers a succinct overview of flexure hinge as a critical element in the context of precision mechanism design, particularly of flexure-based quartz crystal resonators for seismic sensing.

Professor Lifang Qiu and a team from University of Science and Technology Beijing, China proposes a multi-objective optimization model and a computer-aided platform enabling the design of various shapes of symmetric, single-axis flexure hinges by considering performance qualifiers such as capacity of rotation, precision of rotation and stress levels.

The paper by Professor Guimin Chen and a colleague from Xi'an Jiaotong University, China introduces a new double cross-spring compliant revolute joint connecting two cross-axis flexure pivots aimed at eliminating the parasitic drift. The paper presents a kinetostatic model, which is validated by finite element analysis and enables the optimized design of compliant mechanisms incorporating this special joint.

A research team from the University of Alaska Anchorage, USA discusses a new three-dimensional flexible hinge and related tripod mechanism, which can be utilized in transduction applications requiring large, linear-domain motions. The maximum load and displacements are assessed by a compliance approach, which includes the stress concentration effects at the filleted ends.

Professor Lena Zetner and her colleagues from Technische Universität Ilmenau, Germany proposes two methods for the synthesis/design of compliant mechanisms by using rigid-body system theory. The methods are geared to different mechanism tasks and their accuracy, which is confirmed by finite element

analysis and experimental testing, is illustrated by mechanisms that realize straight-axis motion.

The paper by Professor Qingsong Xu and his colleague from the University of Macau, China studies a versatile compliant gripper with large clamping range, high natural frequency and piezoelectric actuation. The mechanism, which utilizes bridge and parallelogram units, is optimized by a kinematic model whose validity is confirmed through finite element simulation and experimental testing.

The research team from the Technical University of Cluj-Napoca, Romania and École Nationale d'Ingénieurs de Saint-Etienne, France and led by Professor Dan Noveanu provides a comprehensive finite-element-based study of a two-level-of-amplification compliant gripper. The mechanism is piezoelectrically-actuated and comprises straight-axis flexure hinges. The analysis includes various flexure hinge shapes, different geometric parameters ranges and material properties.

In closing, the authors of this special issue of the Romanian Journal of Technical Sciences-Applied Mechanics would like to express the gratitude for being invited to share some of their most recent research on flexure hinges and flexure-hinge mechanisms. In particular, special thanks are addressed to Professor Dorel Banabic, Member of the Romanian Academy of Sciences, who kindly suggested, initiated, encouraged and made possible the publication of this issue.

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