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## The 7th Symposium on Mechanics of Slender Structures

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## Preface

# 7<sup>th</sup> Symposium on Mechanics of Slender Structures 2017 (MoSS2017)

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This issue of Journal of Physics: Conference Series contains selected technical papers that were presented at the 7<sup>th</sup> Symposium on the Mechanics of Slender Structures (MoSS2017) and show a range of different approaches used in the analysis of slender structures. The meeting was hosted by The Lift Engineering Research Center (INGELEEV) of the University of Extremadura, and was held in Mérida, Spain, from 14<sup>th</sup> to 15<sup>th</sup> December 2017. This conference runs under the auspices of the Institute of Physics Applied Mechanics Group and forms a continuation of a successful meeting series on the Mechanics of Slender Structures first held in Northampton, UK, in 2006, followed by the event hosted in Baltimore, USA in 2008, in San Sebastian, Spain in 2010, in Harbin, China in 2013, in Northampton, U.K. in 2015 and in Shanghai, China in 2016.

The remit of the Symposium on the Mechanics of Slender Structures series involves a broad range of scientific areas. Applications of slender structures include terrestrial, marine and space systems. Moving elastic elements such as ropes, cables, belts and tethers are pivotal components of many engineering systems. Their lengths often vary when the system is in operation. The applications include vertical transportation installations and, more recently, space tether propulsion systems. Traction drive elevator (lift) installations employ ropes and belts of variable length as a means of suspension, and also for the compensation of tensile forces over the traction sheave. In cranes and mine hoists, cables and ropes are subject to length variation in order to carry payloads. Tethers experiencing extension and retraction are important components of offshore and marine installations, as well as being proposed for a variety of different space vehicle propulsion systems based on different applications of momentum exchange and electrodynamic interactions with planetary magnetic fields. Furthermore, cables and slender rods are used extensively in civil engineering; in cable-supported bridges, guyed masts and long-span roofs of buildings and stadia. Suspended cables are also applied as electricity transmission lines. Chains are used in various power transmission systems that include such mechanical systems as chain drives and chain saws. Moving conveyor belts are essential components in various material handling installations. Other structures such as pipelines, plates, membranes, beams, mechanical linkages, and DNA structures also fall into this category.

Tall buildings and towers represent another important class of slender structures. In the modern high-rise built environment tall buildings have increased height and slenderness as well as reduced weight. Such structures are designed to withstand a broad range of external loads such as strong wind and seismic excitation. However, they are prone to structural vibrations and complex resonance phenomena that cause damage, affect their occupants and modular installations such as vertical transportation/lift systems. The performance of these installations plays a significant role in the building operation and a holistic approach is needed in the analysis and design of the structural system.



The MoSS 2017 involved papers devoted to special interests in recent multi-disciplinary applications in the mechanics of slender structures, such as bones mechanics, implants, tendons, soft materials, aeroplane wings, mega-long viaducts and in other new cutting edge technologies.

This meeting brought together experts from various fields: structural mechanics, bio-mechanics, thermo-mechanics, dynamics, electrodynamics, vibration and control, structural health monitoring, artificial intelligence, materials science and applied mathematics to discuss the current state of research as well as rising trends and direction for future research in the area of mechanics of slender structures.

The event is aimed at improving the understanding of structural and thermo-mechanical properties and behaviour of slender structures. The papers presented at the conference covered analytical, numerical and experimental research in various applications of slender structures. The conference programme was arranged around the following six keynote lectures:

**Keynote Lecture 1: Linear and nonlinear dynamic cable-structure interactions**

by John Macdonald, University of Bristol (UK).

**Keynote Lecture 2: Pros and Cons of Beams Modelled with the Absolute Nodal Coordinate Formulation**

by Johannes Gerstmayr, University of Innsbruck (Austria).

**Keynote Lecture 3: Present and Future Vertical Transportation Systems**

by Rory Smith, thyssenkrupp Elevator (USA)/ University of Northampton (UK).

**Keynote Lecture 4: Two decades of research on vibrations of continuous systems and dynamics of elevator systems**

by Weidong Zhu, University of Maryland BC (USA).

**Keynote Lecture 5: WYPiWYG constitutive modelling for soft materials**

by Francisco Javier Montans, University of Madrid (Spain)

**Keynote Lecture 6: Almonte Viaduct in the Madrid – Portuguese Border High Speed Line**

by Pablo Jiménez, ADIF (Spain)

The articles presented in this volume are arranged alphabetically by the first author details and are extended peer-reviewed versions of the papers presented at the conference. The Editors and Organizing Committee gratefully acknowledges support received from the co-sponsoring institutions and would like to thank the authors for their hard work and high quality contributions.

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14-15 December 2017, Mérida Congress Centre, Mérida, Extremadura.