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PREFACE

Preface of: new approaches in bio-computational-material mechanics

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This Special Issue of Meccanica is dedicated to Professor Castrenze Polizzotto, on the occasion of his 100th birthday. Professor Polizzotto, whose academic and scientific activity began in the early 1960s, covered various topics in the Mechanics of Solids and Structures. He has authored more than 200 publications, mainly on the subjects of structural optimization; energetic formulation of the boundary element method; elastoplastic structures under cyclic loads; variational characterization of elastic–plastic-damaging structures; non-local and gradient approaches in elasticity and plasticity.

His contributions in the field of Mechanics are of the highest quality and render him a reference for all those scholars and academics who approach research with passion and scientific curiosity.

Our warmest wishes go to him.

The release of this Special Issue oriented to Biomechanics, Computational Mechanics, and to the Mechanics of Materials is motivated by the observation that these three research fields are becoming increasingly relevant in many modern engineering activities and also by the fact that they share many common features related to modelling techniques, material's constitutive hypotheses and numerical analysis tools. These have been differently declined to face problems of mechanics which are often very different, but, at the same time, representing a common denominator witnessing how rigorous and mathematically based advanced methodologies are nowadays effective tools of general validity to interpret the complex physical phenomena of the solid and fluid mechanics world.

The idea of this SI was born out of the successful GIMC GMA GBMA 2023 Congress, XXIII

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Conference of the Italian Group of Computational Mechanics (GIMC), X Conference of the Group of Mechanics of Materials (GMA), and II Conference of the Group of Biomechanics (GBMA), which was held in Reggio Calabria, Italy, on July 12–14, 2023. The main goal of the conference was to promote and facilitate the interdisciplinary exchange and dissemination of the most recent theoretical and numerical methods in the fields above, which constitute the most advanced frontiers of applied mechanics.

Within such context, this Special Issue collects 9 cross-disciplinary contributions that have been selected for their originality and rigor in the methodologic approach. Some of the contributions timely address current problems in cell mechanics, tissue formation, and bioprintig. In particular, the constitutive modelling of the plasma membrane including visco-elastic behavior is proposed in [1], while advanced chemo-mechanical models for the study of cell migration in the extracellular matrix are the focus of [6]. The development of predictive tools for the design of extrusion-based bioprinting processes and of a computational platform for the analysis of neo-tissue formation, including cell motility and clustering phenomena, are discussed in [4] and [8], respectively. In the context of biomechanics, novel approaches to assess the mechanical behavior and the strength of human bone starting from patient-specific data is presented in [5]. Other topics covered by the SI include the exploitation of soft active materials, such as polyelectrolyte hydrogels, for the design of biomimetic functional structures [2], the peridynamic modeling of peeling phenomena in nonlocal thin films [3], a new combined fabrication process to shape small flexure hinges [7] and recent computational advancements for the structural analysis and optimization of composite laminates with variable stiffness [9].

All the topics covered by the SI are of considerable interest for scholars in theoretical and applied mechanics and we would like to thank all the authors for their valuable contribution.

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