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Editorial to the special issue: Recent advances in Computational Mechanics and Innovative Materials, in honor of Professor J.N. Reddy for his 75th birthday

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This special issue of Meccanica celebrates the 75th birthday of Prof. J.N. Reddy. His professional work and warm personality have greatly inspired a generation of researchers in the broad field of applied mechanics. He made significant contributions to the field through his remarkable output of research papers and widely used textbooks on linear and nonlinear finite element analysis, variational methods, composite materials and structures, applied functional analysis, and continuum mechanics. His writings have also had a major impact on engineering education and led to technological advances around the world.

With this special issue of Meccanica, we celebrate Prof. Reddy's birthday with a thematic focus on "Computational Mechanics and Innovative Materials," which encompasses the large spectrum of scientific topics to which Prof. Reddy has contributed and inspired new research ideas. Many of his friends and collaborators contributed to the present special issue.

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The topics of the special issue span from solids & fluids to statics & dynamics to classical & non-classical continuum mechanics to linear and nonlinear analysis to related topics such as phase-field, constitutive modeling, origami mechanics, biomechanics, novel numerical methods, material design, and optimization. The papers are organized into 5 non-unique groups: (1) papers co-authored by Prof. Reddy and related work; (2) novel numerical methods; (3) multiphysics; (4) composites; and (5) interdisciplinary. Each of the nineteen papers are briefly outlined below according to the aforementioned categories.

The first two papers are co-authored by Prof. Reddy himself [1, 2]. Raghu et al. [1] present a phase-field model for fracture of thick plates under dynamic loads. Romanoff et al. [2] investigate post-buckling of web-core sandwich plates based on classical continuum and point out the need for non-classical continuum mechanics, which is a topic addressed by a few other authors. For instance, Romano and Diaco [3] present a theoretical account of nonlocal problems in elasticity. Pinnola et al. [4] use a nonlocal approach to model damped small-scale beams. Surana and Carranza [5] demonstrate the influence of internal rotations on the dynamic response of solid continua. In connection with the phase-field method [1], Bijaya and Chowdhury [6] address fracture problems considering finite strains.

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The next group of papers addresses novel numerical methods in computational mechanics including the variational multiscale method (VMS) for incompressible flows by Kang and Masud [7], the virtual element method (VEM) for nearly incompressible materials by Park et al. [8], the generalized finite element method (GFEM) for fracture of composites by Alves et al. [9], and the Carrera Unified Formulation (CUF) for stress analysis by Filippi and Carrera [10].

On the multiphysics front, the contributions include visco-poroelastic formulation for gels by He and Hu [11], constitutive response of dielectric elastomers by Ghosh and Lopez-Pamies [12], and chemo-mechanical modeling of solid-state batteries by Bistri et al. [13].

With regard to composite materials, the research includes determining stacking sequences in composite laminates through the integrated design optimization approach by Cutolo et al. [14], and the two-step Bayesian framework for estimating effective elastic constants of single plies within a multi-laminate polymer matrix composite by Castillo and Kalidindi [15].

Finally, the interdisciplinary group of papers includes post-bucking analysis of elasto-plastic framed structures and curved structures by Yang et al. [16], study of curved creases as a means to redistribute global bending stiffness in corrugations by Woodruff and Filipov [17], investigation of the response of cells on a bed of micro-posts idealized as a Winkler foundation using a homeostatic mechanics framework by Vigliotti et al. [18], and coarse-graining for polymeric metamaterial design by Varma and Sarkar [19].

As Prof. Reddy's books have motivated research in their topical areas, it is our hope that the work presented here will serve as a source of inspiration for further advancements in computational mechanics and innovative materials.

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