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EDITORIAL OF THE SPECIAL ISSUE
NEW TRENDS IN ADVANCED COMPOSITES

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This issue of ROMANIAN JOURNAL OF TECHNICAL SCIENCES – APPLIED MECHANICS, is named, for good reason, "New Trends in Advanced Composites". From time-to-time it is beneficial to look ahead to some of the up-and-coming tendencies in new composites. In recent years, a lot of attention has been paid to the applications of composite materials with multiple excellent properties that any of traditional materials.

In this issue, we will take a look *to four current trends* with big potential.

The first topic refers to sonic composites (or sonic crystals) which are attractive materials for controlling and manipulating differently the flow of the sound and lighting, respectively. A sonic composite is a finite size periodic array composed of scatterers embedded in a homogeneous material. This composite is a sonic version of a photonic crystal, which is composed of periodic dielectrics that affect the propagation of electromagnetic waves by defining allowed and forbidden electronic energy bands. It is interesting to find that the atmosphere represents a natural sonic composite exhibiting the full band-gaps and localized modes around inhomogeneities given by the wind-velocity jumps. One of the paper analyses a barometric model including inhomogeneities which are modeled as Somigliana dislocations.

The second topic refers to composites made out of stalk based maize fiber and unsaturated polyester resin polymer as matrix with methyl ethyl ketone peroxide as a catalyst and Cobalt Octoate as a promoter.

The natural fibers can enhance the properties of polymers as interfacial adhesion, orientation, strength and physical properties. The mechanical properties of polymer composites based on natural fibers depend essentially on the interface adhesion between the fibers and the polymer matrix. This is because natural fibers are rich in cellulose, hemicellulose, pectin and lignin and tend to be strong and hydrophilic (attracts water) while presenting significant hydrophobic polymers (water repelling for reinforced materials with randomly distributed natural fibers of maize (stalk). The hysteretic behavior of such composites described by a Preisach-Bouc-Wen model highlights the superior attenuation properties strong demanded in many technical applications, especially where the control of noise and vibration and high strength and stiffness are required, but with low component weight.

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Composites with negative stiffness inclusions encapsulated by a polymer matrix, represent *the third topic* of this issue. Negative stiffness inclusions exhibit an unusual behavior: when they are subjected to a mechanical load, after a certain force and during a certain displacement (still in the elastic region), the force decreases with displacement. This property is usually unstable, but the inclusions of negative stiffness can be stabilized within a positive-stiffness material. The FCC crystal cell belonging to the cubic system is subjected to a stress-free biaxial deformation in the [111] direction, becoming trigonal and then by applying a surface biaxial traction to the trigonal crystal, it is incorporated into the polymeric matrix by assuring the continuity of displacements and normal stresses across the boundaries. The damping capacity of this composite have important applications to vibration and noise control.

The last topic refers to polyurethane (PUR) foam, ideally suited as packing materials or dampers for many safety applications because of its chemical and design versatility and excellent energy absorbing properties. The effect of density, material orientation (anisotropy) and temperature on the main mechanical properties of cellular materials such as rigid polyurethane (PUR) foam are investigated. Rigid polyurethane foams are widely used in engineering applications because they have certain properties that cannot be elicited from many homogeneous solids. Some properties are highlighted in the article. We refer to increasing of density, which means that the density has an important role in determining the dynamic compressive mechanical behavior. The loading direction has a major influence on the mechanical properties in dynamic conditions, clear evidence of anisotropic behaviour of foam. For the same foam density in-plane loading direction a constant plateau was obtained, while for out-of-plane load the plateau presents a linear hardening.

We are also grateful to the reviewers for the time and effort they spent evaluating the papers. We believe that this issue will be a valuable contribution to the field of Advanced Composites and a source for further development and scientific discussion within this still growing branch of mechanical engineering.

The guest editors,

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