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MULTIPHYSICS OF FIBROUS MATERIALS

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ABSTRACT

Many natural and man-made materials have a network of fibres as their structural component. Examples from the biological realm include the cellular cytoskeleton, extracellular matrix, cartilage and other connective tissues, and insect cuticles. A large number of artificial materials and structures can also be classified in this category: rubber and gels, paper, insulation materials, non-wovens, and various consumer products. These systems contain networks of filaments with dimensions ranging from molecular to macroscopic. In all cases, the network performs multiple functions, including structural/mechanical and transport.

This symposium is dedicated to the investigation of various aspects of the physics of such systems, including their multiscale mechanical and transport behaviours and their biological functions. While the behaviour of individual fibres is known in most cases, the emergent behaviour of the structure of filaments is much less understood. In particular, the relationship between the geometric and physical properties of fibres and the network architecture on one hand, and the multiphysics macroscale behaviour of the ensemble of fibres on the other hand, is a subject of intense ongoing research. The formulation and identification of proper rheological models accounting for the multiscale aspects of these structures remain challenging nowadays.

Subjects include: ● tissue mechanics, ● paper, ● non-wovens and technical textiles, ● carbon nanotube networks, ● polymeric networks and gels, ● homogenization methods / multiscale models / multiphysics coupling, ● rheological/constitutive models, ● generalized continua, ● multiscale characterization of microstructures, ● hygromechanic and acoustomechanic couplings, ● stochastic failure, ● mechanical testing for identification and validation purposes.