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GEOMETRY IN MECHANICS OF MATERIALS

A. Srikantha Phani[1*]

[1]Department of Mechanical Engineering, University of British Columbia, Vancouver, BC, Canada, V6T1Z4
*srikanth@mech.ubc.ca

ABSTRACT

Geometry plays an essential role in the mechanics of solids. Engineers are familiar with design parameters such as section modulus, and shape factor in the structural design of beams. The emergence of advanced manufacturing technologies and optimization methods in the last two decades have renewed interest in exploiting geometry in the context of multifunctional materials and structures over several length scales. Architected materials exploit the synergies between topology and macroscopic response of materials and structures under loads. The traditional notion of structures made out of material is inverted, since now materials are made of structures that can be designed over multiple length scales. Several potential engineering applications have emerged under the name of phononic materials and metamaterials to tailor wave propagation and static material response. Equally, fundamental solid mechanics problems related to homogenization methods have come to the fore, given the interest in developing efficient computational methods and placing bounds on effective material properties. This seminar will survey opportunities and challenges that arise in exploiting geometry to tailor mechanical response of materials, focusing on my group's activities at UBC. Wave propagation and vibroacoustic response tailoring opportunities for structures with an architected core are highlighted. Challenges that arise in the homogenization of architected materials are discussed in the context of fracture toughness of elastic-brittle materials. The seminar will conclude with potential opportunities for Canadian industry and universities to engage with this growing field.

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