Elastic Stress Wave Tailoring using Architected Metamaterials

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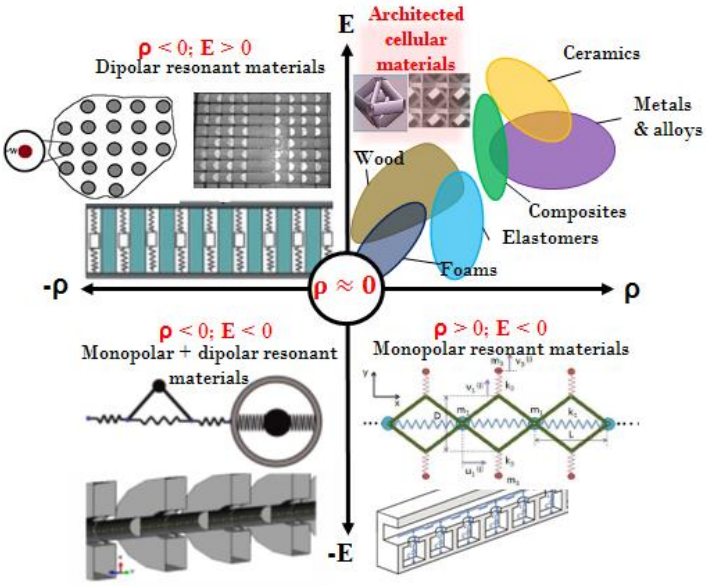
Abstract: Metamaterials are a new class of materials that provide an unprecedented control over the mechanical behavior of a structure by decoupling previously interdependent properties while simultaneously expanding the material property space. Bulk properties of metamaterials are independently controlled by treating their local architectural and material properties as additional degrees of freedom and exploiting their linked behavior. Further, by manipulating their sub-structural resonance, metamaterials can be designed to exhibit frequency-dependent properties, including negative values of materials properties such as stiffness, density, Poisson's ratio, and thermal coefficient. This talk will present the fundamental concepts of elastic wave propagation and review the possibility of controlling elastic stress waves using phononic structures and locally resonant metamaterials. The idea of leveraging sub-structural material architecture to develop ultra-lightweight, high stiffness and high strength materials for various applications such as sandwich cores, sub-wavelength acoustic and elastic cloaks, seismic barriers, and super-thin acoustic liners will also be presented.



Bio: Dr. Bhisham Sharma is an Assistant Professor in the Department of Aerospace Engineering at Wichita State University. He obtained a PhD in Aeronautics & Astronautics from Purdue University and performed postdoctoral work in the fields of composites and cutting mechanics for two years at Purdue University. At WSU, his research focuses on the development and application of advanced material systems for applications including stress wave control, impact energy mitigation, enhancing vibroacoustic behavior of spacecraft structures, and aircraft engine noise reduction. Projects in the area of experimental mechanics include investigating dynamic deformation behavior of nano-architected lattice materials using in situ high-speed phase contrast imaging and utilizing acoustic emission monitoring for damage detection during commercial composite machining.