

Multi-scale approach to analysis and design of subwavelength mechanical and acoustic metamaterials

Abstract:

This talk will present the recent advancements in the computational homogenization techniques for modelling elastic and acoustic wave propagation in locally resonant metamaterials on finite size domains in both frequency and time domains, including transient regimes.

I will start by describing the main idea of the transient computational homogenization approach that allows the direct simulations of wave propagation and attenuation on finite size domains. The general approach is suited for arbitrarily complex unit cell geometries and material behavior, including material and geometrical non-linearities. As an example, illustrating the emergent behavior due to non-linearities, energy transfer by an auto-parametric resonance from propagative to evanescent wave will be shown. Next, extensions and applications of the approach will be presented for visco-elastic (lossy) metamaterials, porous materials including fluid-solid interaction and acoustic labyrinthine metamaterials.