Introduction to Phononic Crystals and Metamaterials

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Résumé

1.Simple analytical models to introduce basic notions

Band gaps and localized modes associated to defects Zeros of transmission and Fano resonances

2. One-dimensional (1D) multilayer structures

Theoretical methods
Dispersion curves, band gaps and localized modes
Transmission coefficient: tunnelling (fast)transmission and resonant (slow) transmission

3. Two-dimensional (2D) Phononic crystals

Theoretical methods
Dispersion curves and complete band gaps (Bragg gaps and hybridization gaps) Local resonances and low frequency gaps
Waveguide and cavity modes

4. Phononic crystal slabs and nanobeams

Array of holes in a Si membrane
Array of pillars on a thin membrane
Surface waves in semi-infinite phononic crystals
Nanobeam waveguides

5. Brief overview of refractive properties

Negative refraction and focusing Self-collimation and beam splitting

6. Subwavelength structures and applications of metamaterials

Effective properties (positive and negative dynamic parameters) Focusing and imaging. Superlens and heperlens
Cloaking
GRIN devices

*Intervenant

Metasurfaces. Resonating units and space coiling. Absorption. Phase manipulation 7. Active materials and some emerging topics

Non reciprocal behaviors . Time-space periodicity. PT symmetry. Topological phononics.

8. Dual phononic-photonic crystals (phoXonic) and Optomechanics

Simultaneous phononic-photonic band gaps.

Waveguide modes. Slow and fast modes

Enhanced phonon-photon interaction in a cavity. Comparison of photoelastic and optomechanic effects

Phononic and Phoxonic sensors