Waves in metamaterials and periodic structures

Lecturers: O. S. Bursi, F. Dal Corso, V. Dal Poggetto e G. Oliveri
Duration: 16 hours - 2 credits with homework
Period: 17-19 Aprile 2024

ToC

Prof. Francesco Dal Corso and V. Dal Poggetto 6 hours

Introduction to mechanical waves propagation in continuous and discrete systems - One-dimensional longitudinal mechanical wave equation - Discrete one-dimensional systems (monoatomic, diatomic, and monoatomic resonant chains) - Out-of-plane dynamics of planar discrete systems	DAL CORSO
1 Basic concepts on wave propagation 1.1 Non-dispersive waves and phase velocity 1.2 Dispersive waves and group velocity 1.3 Wave interaction 1.4 Periodic one-dimensional medium **2 One-dimensional wave propagation** 2.1 Longitudinal wave propagation 2.2 Transfer matrix method 2.3 Transverse wave propagation 2.4 Finite elements with periodic boundary conditions 2.5 Plane wave expansion method **3 Two-dimensional wave propagation in plate structures** 3.1 Generalized periodic media 3.2 Bloch's theorem 3.3 Plane wave expansion applied to plates 3.4 Finite element formulation **4 Acoustic application of metamaterial plates**	DAL POGGETTO

Prof. Giacomo Oliveri and Prof. Andrea Massa – 4 hours

The nature of Electromagnetic Waves – Maxwell's Equations and the EM Wave Equation Canonical Solutions to Maxwell's Equations: Plane Waves in Homogeneous Media Waves and planar interfaces? The Snell's Laws	MASSA
Periodic and Quasi-Periodic Metamaterials: concept, design, implementation Waves and Metamaterials - the Generalized Snell's Laws Applications of Generalized Snell's Laws to Wave Control in EM Systems	OLIVERI

Prof. Oreste S. Bursi – 6 hours

Metastructures for seismic vibration mitigation of process plant components Metamaterial and metastructure concepts Modeling and machine learning Structural (passive) control Random vibrations Attenuation and non attenuation zones Nonlinear issues: bistable, quasi-zero stiffness devices. Shaking table experiments Vibration mitigation of liquid storage tanks Vibration mitigation of small modular reactors	BURSI