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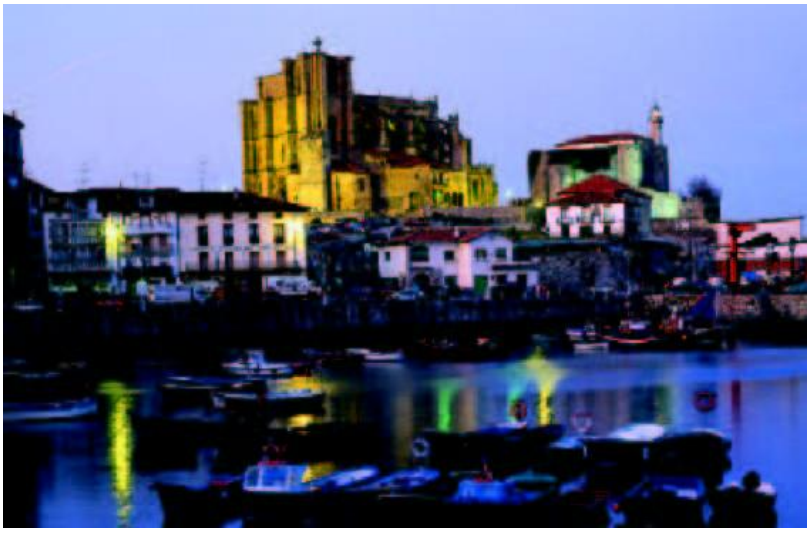

Views of Castro Urdiales, Spain

Elastic waves in two-phase composite quasicrystalline-generated metamaterials: scaling of frequency spectra and negative refraction

Massimiliano Gei[1], Lorenzo Morini[1]

[1]*School of Engineering, Cardiff University, The Parade, Cardiff CF24 3AA, UK*
E-mail: *geim@cardiff.ac.uk*

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The talk refers to a detailed investigation of scaling and self-similarity of the frequency spectra of axial waveguides composed of repeated elementary cells designed by adopting the class of quasicrystalline Fibonacci substitution rules. For this problem, an invariant function of the circular frequency, the Kohmoto's invariant, governs self-similarity and scaling of the stop/pass band layout within defined ranges of frequencies at increasing generation index [1,2]. The Kohmoto's invariant also explains the existence of specific frequencies, named *canonical frequencies*, associated with closed orbits on the geometrical three-dimensional representation of the invariant.
In the second part, the problem of an antiplane wave obliquely incident at the interface between an elastic substrate and a quasicrystalline laminate is investigated. The substrate-laminate system is studied by combining the transfer matrix method to the normal mode decomposition. The refraction angles associated with the transmitted modes are estimated by means of the space averaging procedure of the Poynting vector [3]. We show that the Floquet-Bloch spectrum corresponding to this class of laminates is characterized by a self-similar structure similar to that observed for axial waveguides studied previously. Moreover, high-order Fibonacci laminates can provide pure negative wave refraction at lower frequencies with respect to the periodic two-phase multilayered materials used for the design of several phononic devices [3].
The obtained results represent an important advancement towards the realisation of composite quasicrystalline metamaterials.

References

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