Abstract:
Waves in periodic media undergo multiple scattering and interference. As a result, their frequency spectrum is divided into bands in which waves pass freely, and gaps in which waves cannot propagate. This band diagram depends on the physical and geometrical properties of the periodic cell, through a dispersion relation.

Using a new representation of the dispersion relation of laminates, we show that their frequency spectrum admits a universal structure, independent of the thickness of each constituent and its particular physical properties. This structure allows deriving the maximal and average width, and the density of the gaps in the spectrum—the latter found to be universal. Rules for tailoring laminates according to desired spectrum properties thereby follow.

We also show that various soft laminates—whose diagram is tunable—are also endowed with the same structure. Our representation facilitates characterizing this tunability, as we demonstrate via examples.

This talk is based on a joint work with Ram Band.