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Wave redirection and confinement via elastic meta-lattices

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Recent progress in Additive Manufacturing (AM) enables the creation of cellular architectures with unique mechanical performances [1] which can be used as effective wave diffractors, lenses, filters, or localizers [2, 3]. Inspired by the advanced wave manipulation performances of elastic substrates with resonators [4], we design elastic meta-lattices capable of generating non-reciprocal wave propagation. The proposed meta-lattice (Fig. 1) combines chiral structures together with local resonance, to induce circular wavefield for wave confinement.

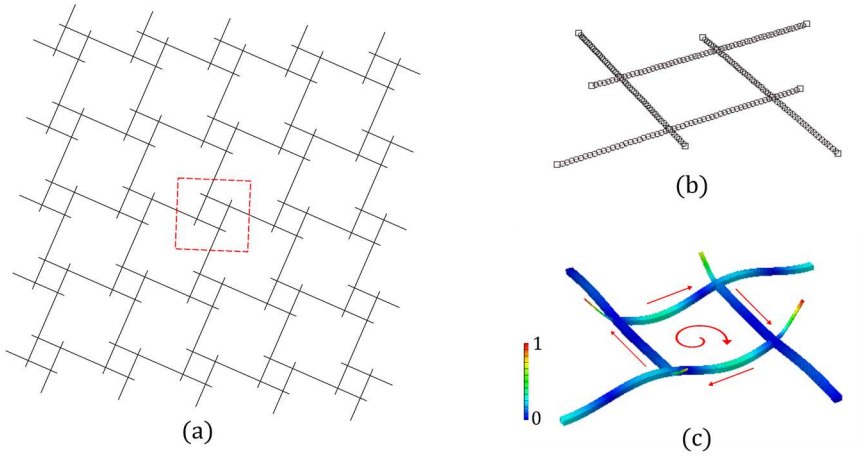

Fig. 1. (a) Meta-lattice structure for wave confinement. The structure is obtained through a periodic repetition of the unit cell (b) modelled using Timoshenko beam finite elements. The introduction of local resonators inside the structure allows to induce a circular wavefield.

The lattice is modelled using Timoshenko (shear flexible) beams in space with 6 degrees of freedom in each node. This allows to reduce the high computational cost of the simulations that would arise when using full 3D solid elements.

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