

Ornella Mattei

Title: On the effects of suitably designed space microstructures in the propagation of waves in time modulated composites

Abstract: The amplitude of a pulse that propagates in a homogeneous material whose properties are instantaneously changed periodically in time will undergo an exponential increase, due to the interference between the reflected and transmitted pulses generated at each sudden switch. In this talk we will see how to resolve the issue by designing suitable reciprocal PT-symmetric space-time microstructures, both in the one-dimensional and two-dimensional cases, so that the interference between the scattered waves is such that the overall amplitude of the wave will be constant in time in each constituent material. Remarkably, for the geometries here proposed, a pulse will propagate with constant amplitude regardless of the impedance between the constituent materials, and for some, regardless of the wave speed mismatch. Given that the energy associated with the wave will increase exponentially in time, this creates the possibility to exploit the stable propagation of the pulse to accumulate energy for harvesting.

Relevant papers:

[1] On the effects of suitably designed space microstructures in the propagation of waves in time modulated composites. O. Mattei, V. Gulizzi, 2023. Appl. Phys.Lett. 122, 061701.
DOI: <https://doi.org/10.1063/5.0132899>

[2] Field patterns: A new type of wave with infinitely degenerate band structure. O.Mattei, G.W. Milton, 2017. Europhys. Lett. 120(5), 54003.
DOI: <https://doi.org/10.1209/0295-5075/120/54003>

[3] Field patterns without blowup. O. Mattei, G.W. Milton, 2017. New J. Phys. 19 093022.DOI: <https://doi.org/10.1088/1367-2630/aa847d>;

[4] Field patterns: A new mathematical object. G.W. Milton, O. Mattei, 2017. Proc. R. Soc.A 20160819. DOI: <http://dx.doi.org/10.1098/rspa.2016.0819>