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**Metamaterials from discrete models** MARC SERRA GARCIA, KATHRYN MATLACK, Swiss Federal Institute of Technology (ETH), ANTONIO PALERMO, University of Bologna, SEBASTIAN HUBER, Swiss Federal Institute of Technology (ETH), CHIARA DARAIO, California Institute of Technology —
Lumped element models containing capacitors and inductors or masses and springs are a powerful tool to discuss metamaterial performance, because they allow us to describe a material's dynamics without having to take into account the particular implementation details (e.g. the exact geometry that results in the desired dynamics). This talk will discuss the extraction of reduced-order models from metamaterial designs in the perturbative regime, where there's weak coupling between the metamaterial's unit cells. In this regime, we can obtain discrete models by performing a rotation of the unit cell modal basis, to separate the dynamics in the frequency range of interest from the irrelevant behavior at other frequencies. Systems with moderate coupling strengths present long-range interactions, while for low coupling strengths we observe a one-to-one correspondence between geometric features and dynamical matrix elements. This relation can be exploited to engineer advanced performances such as topological bands or hyperbolic dispersion.

Marc Serra Garcia
Swiss Federal Institute of Technology (ETH)

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