Sep 17th, 12:00 AM - Sep 19th, 12:00 AM

Emergent Wave Phenomena in Coupled Elastic Bars: From Extreme Attenuation to Realization of Elastodynamic Switches

Qianli Chen
UIUC, qchen35@illinois.edu

Ahmed Elbanna

IUTAM Symposium Architectured Material Mechanics,
T. Siegmund, F. Barthelat, eds
September 17-19, 2018, Chicago, IL, USA, , Chicago, IL, USA

Emergent wave phenomena in coupled elastic bars: from extreme attenuation to realization of elastodynamic switches

Qianli Chen[1], Ahmed Elbanna[2]
[(1)]University of Illinois at Urbana Champaign, qchen35@illinois.edu
[(2)]University of Illinois at Urbana Champaign, elbanna2@illinois.edu

KEYWORDS: Metamaterial, elastic band gap

Metamaterials with acoustic and elastic band gaps are of great interest to scientists and engineers. Here[1], we introduce a novel mechanism for emergence of multiple band gaps with extreme attenuation by coupling continuous one-dimensional elastic structures. We show that it is possible to develop extreme attenuation at several frequencies from coupling two homogenous bars of different elastodynamic properties even though each bar individually possesses no such gaps. Moreover, if each bar is a composite on its own, multiple resonant band gaps appear in the compound system which do not exist in either bar. We verify our results by conducting numerical simulations for the elastodynamic response and show that the resonant gaps are efficient in attenuating wave propagation. Furthermore, we show that by carefully tailoring the properties of the coupled bars we may construct elastodynamic signal choppers. These results open a new gate for designing Metamaterial with unique wave modulation properties.

Acknowledgments

We thank Ankit Srivastava, Katie Matlack and Darin Peetz for the intriguing discussions. We acknowledge support from the Campus Research Board of University of Illinois (Grant: RB17043) and support from Siebel Institute of Energy.

References

[1] Q. Chen and A. Elbanna, “Emergent wave phenomena in coupled elastic bars: from extreme attenuation to realization of elastodynamic switches,” *Sci. Rep.*, vol. 7, no. 1, p. 16204, 2017.