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Strategy for designing broadband vibration isolation systems through exactly solvable models of graded elastic networks KA KI NG, WAI SOEN CHAN, KIN WAH YU, Department of Physics, The Chinese University of Hong Kong — Motivated by the need of seismic base isolation, we have proposed a strategy to design vibration isolation systems to achieve near-zero amplitude vibration under external excitations over a broad frequency band. The strategy combines two ideas from previous works: (i) zeros assignment for broadband epsilon-near-zero metamaterials [Sun, and Yu (2012)]; and (ii) the localization of vibrational modes in graded elastic networks [Xiao, Yakubo, and Yu (2006)]. Firstly, we aim to assign zeros (anti-resonance frequencies) over an operating frequency band. Starting from an exactly solvable model of zigzag diatomic chains, we demonstrate a one-to-one correspondence between the zeros and one type of the masses after solving the models. Hence, the zeros can be assigned at will by tuning the masses. Secondly, in order to achieve further vibrational suppression by gradon localization, a band overlapping picture is applied to tune the rest of the masses to an optimal value. The results can be generalized to 2D and 3D structures for more realistic applications.

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