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Acoustic energy absorption and dissipation characteristic of Helmholtz resonator enhanced and broadened by acoustic black hole

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Abstract: In the present analysis, a novelty Helmholtz resonator (HR) enhanced by the acoustic black hole (ABH) is established. Dynamic partial differential equations are formulated according to the equilibrium of the flexible plate under harmonic uniformly distributed load, and the load is generated by acoustic fluids in the coupled system. By applying the Wentzel-Kramer-Brillouin (WKB) method, two fundamental functions are respectively assumed to describe the characteristic in the fluid and solid fields, and then the functions are determined by the boundary conditions and continual properties of the coupled structures. Moreover, relationships between the two functions are identified. By utilizing the energy conservation theorem of the closed system, energy storage and absorption characteristic in HR and ABH are separately calculated, which is further depicted as the normalized energy absorbed according to the input and output of the system, then energy transmission loss of the coupled system is calculated. The factors influence on the energy transmission loss in the frequency domain are quantitatively and qualitatively analyzed, especially the ABH parameter *m*. Finally, comparison is presented, the analysis shows the advantage of the coupled system by comparing with traditionally HR.

Keywords

Acoustic energy, Helmholtz resonator, Acoustic black hole, Energy absorption and dissipation.

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