

A MECHANICAL WAVE SWITCH WITH CONTROLLABLE FREQUENCY OUTPUT

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ABSTRACT

The capability of tuning mechanical and acoustic waves is attractive from both scientific and application points of view. A number of mechanical metamaterials have been developed to manipulate waves, while few works focus on the controllability on the frequency and energy flow direction simultaneously. A controllable frequency output mechanical switch (CFOAS) is proposed and is composed of a bilinear difference frequency generation (DFG) unit and a wave filter. The bilinear DFG unit consists of two masses connected by a bilinear spring. The wave filter is a one-dimensional mass-spring lattice. Both numerical and experimental results show that the proposed CFOAS is capable of controlling the direction and frequency of the wave propagation. Moreover, a small amplitude wave signal is sufficient to control a large amplitude input wave signal. This scale-independent device can be realized at micro- and nano-scales.