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Multifractality of instantaneous normal modes at mobility edges
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In terms of the multifractal analysis, we investigate the characteristics of instantaneous normal modes (INMs) at mobility edges (MEs) of a simple fluid, where the locations of two MEs in the INM spectrum were identified in a previous work (Phys. Rev. E 79, 041105 (2009)). The mass exponents and the singularity spectrum of the INMs are obtained by both the box-size and system-size scalings under the typical average. The INM eigenvectors at a ME exhibit a multifractal nature and the multifractal INMs at each ME yield the same results in generalized fractal dimensions and singularity spectrum. Our results indicate that the singularity spectrum of the multifractal INMs agrees well with that of the Anderson model at the critical disorder. This good agreement provides a numerical evidence for the universal multifractality at the localization-delocalization transition. For the multifractal INMs, the probability density function and the spatial correlation function of squared vibrational amplitudes are also calculated. The relation between probability density function and singularity spectrum is examined numerically, so are the relations between the critical exponents of the spatial correlation function and the mass exponents of the multifractal INMs. All results will be appeared in Phys. Rev. E.

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