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Waves and fracture in discrete structures. Slepyan's method: its advantages and limitations

We discuss a method proposed by L. I. Slepyan in 1981, which allows one to solve various problems related to wave and fracture propagation in discrete structures. The method has already shown its effectiveness in tackling a wide range of the problems in various periodic structures. Examples: full/bridge crack propagation, phase transition; various lattice geometry (rectangular, triangular); different lattice links (springs/beams). Applying Fourier transform, such problems are eventually reduced to scalar Wiener-Hopf problems with rather complicated kernels, from which nontrivial information about the related processes is extracted. We discuss both advantages and limitations of the method and highlight its possible extension to the area of dynamic destruction of metamaterials (which typically requires matrix factorisation). We conclude by revisiting a few simple problems that demonstrate recent advances in the area.