Apparent Pulse Diffusion due to Disordered Microstructure

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Wave propagation in the presence of disordered (random) microstruture is considered. Acoustic and water waves are two examples. The acoustic pulse attenuation, due to the fine scale layering of the medium, was initially studied by O'Doherty and Anstey in 1971. In this work the O'Doherty-Anstey approximation is carried over to water waves interacting with disordered features of a topography. The multiple scattering, generated by the disordered topography, leads to the apparent diffusion of the propagating pulse. Theoretical results are validated numerically through a semi-implicit, semi-Lagrangian discretization of the nonlinear Shallow Water equations. Numerical experiments show how the method captures, very well, several types of effective media behaviour. The regime of validity of the asymptotic theory is explored computationally. Scientific computing reveals a very robust theory.