

Frequency-domain mesh-free finite difference operator for visco-acoustic wave equation

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We developed a new approach for visco-acoustic wave equation in frequency-domain using a mesh-free method. Recently, full-waveform inversion (FWI) has been used for investigating sub-surface properties with high resolution. One of the problems of FWI is the high computational costs, like computational memory and CPU time. This stems from forward modeling for calculating theoretical waveforms. So, it is important to improve the computational efficiency of forward modeling. There are two categories in forward modeling, i.e. time-domain and frequency-domain. The frequency-domain method has some advantages over the time-domain method. However, the frequency-domain modeling runs up the computational costs if the size of the coefficient matrix becomes large. So, it is important to decrease the degree of freedoms without sacrificing the accuracy. In the present study, we apply a mesh-free finite difference method to the frequency-domain modeling for saving the computational costs. Our numerical results show that the mesh-free finite difference method can improve numerical efficiency in keeping with high-accuracy. This indicates that the method can be an alternative to the conventional grid-based methods.

Keywords: mesh-free finite difference method, frequency domain