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Taking into account small scale inhomogeneities and topography rapid variations in forward modeling and inverse problems in seismology.

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The modeling of seismic elastic wave full waveform in a limited frequency band is now well established with a set of efficient numerical methods like the spectral element, the discontinuous Galerking or the finite difference methods. The constant increase of computing power with time has now allowed the use of seismic elastic wave full waveforms in a limited frequency band to image the elastic properties of the earth. Nevertheless, inhomogeneities of scale much smaller the minimum wavelength of the wavefield associated to the maximum frequency of the limited frequency band, are still a challenge for both forward and inverse problems. In this work, we tackle the problem of elastic properties and topography varying much faster than the minimum wavelength. Using a non periodic homogenization theory and a matching asymptotic technique, we show how to compute effective elastic properties, how to compute local correctors and how remove the fast variations of the topography and replace it by a smooth Dirichlet to Nemann operator at the surface. After showing some 2D and 3D forward modeling numerical examples, we will discuss the implications of such a development for both forward and inverse problems.