SEISMIC WAVE SIMULATION FOR COMPLEX APPLICATIONS USING A HYBRID HIGHER ORDER METHOD

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Very often numerical simulation of seismic wave propagation in earth media is based on low order methods, like finite elements (FEM) and especially finite differences. An appealing alterantive consists in employing high order methods, like spectral elements (SEM). The SEM yields solutions within the same error tolerance of low order methods using a reduced number of grid-points, saving computational effort and memory storage. On the other hand, FEM are better suited for handling problems involving non-linear behaviours or singularities, and allow a more effective mesh refinement. Furthermore, FEM have been used since a long time for dealing with structural engineering applications, where realistic geological media are coupled with the foundations of large structures like bridges or dams.

On the basis of these considerations, we have developed a hybrid method able to couple the SEM and the FEM in order to exploit the main advantages of both methods: the SEM allows to accurately simulate wave propagation on that part of the domain that has a regular geometry and linear behaviour, while the flexibility of the FEM is exploited to treat non-linearities, singularities or complex structures. The resulting algorithm is very flexible and can handle 3D problems characterized by significant geometrical or physical complexity.

We present the last results of our research concerning the development of the method, including its optimization. Performance and capabilities will be described by considering validation tests as well as some examples on realistic field-scale wave propagation scenarios.

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