

Wavefield Generated by the Beirut Explosion: An Application of the Unfitted Hybridizable Discontinuous Galerkin Model

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Understanding and predicting seismoacoustic waveforms may be a real conundrum, depending on the complexity of the source term, but also on the geological features a wavefield is propagating through. Transmission of elastic energy (i.e. coupling) between the solid Earth and fluid layers (atmosphere, ocean) can bring a wealth of information about the characteristics of a source, but may be highly dependent on the geological settings (topography). To overcome these challenges, two numerical tools are presented that can deal efficiently with the propagation of elastic wavefields in complex media. The first is an extension of the now classical finite spectral-element method (SEM) to the so-called hybridizable discontinuous Galerkin (HDG) model. The HDG-formulation allows to mitigate meshing constraints inherent to the SEM at a reasonable numerical cost, by introducing hybrid and nonconforming meshes. Also implemented in the HDG software, the second tool goes further, in the sense that without any loss of numerical convergence, material interfaces need not fit element boundaries, which is the classical paradigm in finite element methods; one coins these, unfitted or cut (finite) elements. Both tools are applied to simulate the accidental Beirut explosion and help to understand seismic conversions in the near-field of the source and receivers.

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Promotional text

Two numerical tools are presented that may help to catch interactions between solid and fluid Earth's layers.

Oral preference format

in-person

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