High-order Discontinuous Galerkin approximations of the elastodynamics equation

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In this talk we present and analyse high order Discontinuous Galerkin methods for the space discretization of the elastodynamics equation. The proposed approach combines the flexibility of discontinuous Galerkin methods to connect together, through a domain decomposition paradigm, Spectral and/or Finite Element blocks where high-order polynomials are used. In such a way, the spatial discretisation and/or the local polynomial degree can be tailored to the region of interest. This approach is particularly well suited for the simulation of complex wave phenomena, such as the seismic response of sedimentary basins or soil-structure interaction problems, where flexibility is crucial in order to simulate correctly the wave-front field. We analyse the semi-discrete formulation as well as the fully-discrete one, which is obtained through an explicit integration scheme. Some validation benchmarks are shown to verify the accuracy, stability and performance of the proposed approach. We also present some simulations of real large-scale seismic events in three-dimensional complex media: from far-field to near-field including soil-structure interaction effects. The numerical results have been obtained with the high performance, open-source numerical code SPEED (https://speed.mox.polimi.it).

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