Stability and convergence of high-order Isogeometric discretizations for acoustic wave problems

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ABSTRACT

In the last decades, an increasing number of works focused on the simulation of acoustic waves propagation in geophysics in order to improve the low-order accuracy of finite difference or finite element methods. Here we extend our previous works on high order approximations based on spectral and spectral element methods to Isogeometric (IGA) discretizations.

In particular, we consider the numerical approximation of 2D acoustic wave problems by Isogeometric methods in space and Newmark's finite difference schemes in time. We investigate the stability with respect to *h*- and *p*- refinements for acoustic wave problems with fully absorbing boundary conditions on the whole boundary, a useful mathematical representation aimed at reducing reflections when truncating the original unbounded domain with a finite one.

We present several numerical experiments on the stability and convergence of Newmark schemes considering Cartesian and curvilinear domains, for both standard test solutions and Ricker wavelets, with respect to the numerical parameters, namely the local polynomial degree p, regularity k, mesh size h of the NURBS basis functions and the time step size Δt of the Newmark scheme.

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