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Special Short Wave Finite Elements for Flow Acoustics

Jeremy Astley, Pablo Gamallo

University of Southampton, Southampton, UK

It is well known that the standard Finite Element Methods are not well suited to solving 3D harmonic wave propagation problems in which the wavelengths involved are much smaller than the typical dimensions of the problem domain. A special finite element method is proposed here to tackle this type of problem in a more computationally efficient manner using fewer degrees of freedom. The present study focuses on flow acoustic problems but the method proposed is applicable to other wave propagation problems which include inhomogeneous convective effects. The method is based on the Partition of Unity Finite Element Method in which a suitable local basis is included in the approximation space to take account the known local characteristics of the solution, i.e. highly oscillatory behaviour modified by the anisotropic and inhomogeneous effects of the mean flow. Two-dimensional and axisymmetric numerical experiments are carried out to prove the feasibility of the method.

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