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BERNSTEIN - BÉZIER BASED FINITE ELEMENTS FOR EFFICIENT SOLUTION OF SHORT WAVE PROBLEMS

A. El Kacimi[1], O. Laghrouche[2], M.S. Mohamed[2] and J. Trevelyan[3]

[1] Laboratory of Modeling and Combinatorial, FP Safi, Cadi Ayyad University, Morocco, ab1kacimi@gmail.com

[2] Institute for Infrastructure and Environment, Heriot-Watt University, Edinburgh EH14 4AS, UK, o.laghrouche@hw.ac.uk, m.s.mohamed@hw.ac.uk

[3] School of Engineering and Computing Sciences, Durham University, Durham DH1 3LE, UK, jon.trevelyan@durham.ac.uk

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In this work, the Bernstein-Bézier Finite Element Method (BBFEM) is implemented to solve short wave problems governed by the Helmholtz equation on unstructured triangular mesh grids. As for the hierarchical Finite Element (FE) approach, this high order FE method benefits from the use of static condensation which is an efficient tool for reducing the total number of degrees of freedom and bandwidth of high order FE global matrices. The performance of BBFEM with static condensation (BBFEMs) is assessed via three benchmark problems and compared to that of the Partition of Unity Finite Element Method (PUFEM) in terms of accuracy, conditioning and memory requirement. Numerical results dealing with problems of Hankel sources interference and wave scattering by a rigid cylinder on quasi-uniform mesh grids indicate that BBFEMs is able to achieve a better accuracy but PUFEM is slightly better conditioned when the wave is not well resolved. However, with a sufficient wave resolution, BBFEMs is better conditioned than PUFEM. Results from L-shaped domain problem, with non quasi-uniform mesh grids, show that the conditioning of BBFEMs remains reasonable while PUFEM with large numbers of enriching planes on mesh grids locally well resolved leads to ill-conditioning.