Application of IsoGeometric Analysis for Boundary Integral Equations: Comparison to Fast Multiple Method for 2D problem

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ABSTRACT

In the last decades, Boundary Element Method (BEM) has been widely used in many areas such as acoustics, solid mechanics and geophysics. In comparison to the most used Finite Element Method (FEM), BEM reduces the problem dimension by one. However, it involves many drawbacks related to the system resolution. The BEM system matrix is fully populated. Consequently, the matrix construction step is time consuming and the efficient resolution algorithm for sparse matrices usually used in FEM can not be applied. To overcome this problem, a fast version of BEM, called Fast Multipole Method (FMM), has been developed to accelerate the matrix calculation step and the resolution by iterative solver. On other hand, the IsoGeometric Analysis (IGA) has been successfully applied in many problems modeled by FEM and begins recently to be combined with BEM [1]. It presents the advantages to use the exact geometry with less elements. In this work, IGA is applied with the direct collocation BEM in case of 2D potential problems and compared to the FMM. The later is based on constant elements [2] while the Non-Uniform Rational B- Spline (NURBS) functions are considered in BEM. Comparisons are performed in terms of accuracy, computational time and memory requirements.

REFERENCES

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