Efficient integration in domains defined by NURBS in the Cartesian grid Finite Element Method

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ABSTRACT

In this work, we propose an efficient method for the numerical integration in elements within the Cartesian grid Finite Element Method framework. In this method the analysis domain is embedded in a hierarchical set of Cartesian grids [1]. Therefore, there will be elements internal to the domain and elements cut by the boundary. The numerical integration over the boundary elements requires special attention, as the boundary of the analysis domain is completely independent of the elements.

When faceted approximation of the domain are used, then the numerical integration is simple and fast, but at the cost of introducing geometry-modelling errors that may affect the accuracy of the numerical results and the convergence rate of the solution. This geometry modelling errors can be reduced if the definition of the geometry, usually by means of NURBS surfaces, is considered through the integration process. However, the integration of the exact geometry usually implies a substantial increase of the computational cost.

The aim of the proposed method is to minimize the geometry modelling errors keeping a reduced number of integration points. The performance of the method proposed is compared with the faceted approximation and the technique proposed in [1] in terms of accuracy and efficiency.

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REFERENCES

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