An Isogeometric approach in SGBEM

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The Boundary Element Method (BEM) has historically offered engineers an alternative technique to finite elements for certain classes of problems including infinite domains or those involving discontinuous and singular fields. On the other side, isogeometric analysis (IgA) is a new method for the numerical treatment of problems governed by PDEs. It establishes a strict relation between the geometry of the problem domain and the approximate solution representation, giving surprising computational advantages. IgA has also brought a renewed interest for BEMs in computational mechanics, since one has to consider only a discretization of the domain boundary, which can be done in an accurate way by geometric modeling techniques.
In this context, the aim of the present contribution is that of investigating, from a numerical point of view, the Symmetric Galerkin Boundary Element Method (SGBEM) devoted to the solution of 2D boundary value problems for the Laplace equation, where the boundary and the unknowns on it are both represented by B-splines. We mainly compare this approach, which we call IGA-SGBEM, with a curvilinear SGBEM [2], which operates on boundaries having explicit parametric representation (hence, in particular, given by B-spline representation) and where the approximate solution is obtained using Lagrangian basis. Both techniques are further compared with a standard (conventional) SGBEM approach, where the boundary of the assigned problem is approximated by linear elements and the numerical solution is expressed in terms of Lagrangian basis. Several examples will be presented and discussed, underlying benefits and drawbacks of all the above-mentioned approaches.

References

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