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BOUNDARY ELEMENT ANALYSIS WITH TRIMMED NURBS AND A GENERALIZED IGA APPROACH

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The boundary element method (BEM) has offered an alternative to the finite element method and has been attractive for certain types of problems such as ones involving an infinite or semi-inifinite domain [1].

The isogeometric approach has led to renewed interest in the method because, since the method only requires a surface discretization, a direct link can be established with geometric modeling technology, without the need to generate a mesh. Using NURBS instead of the traditional Serendipity or Lagrange functions for describing the variation of boundary values, additional benefits are gained because of their higher continuity and efficient refinement strategies [2].

Trimmed NURBS patches have been successfully applied to problems where two solids intersect. Such models can be created quickly in a CAD program and data exported in IGES format. The exported IGES data contain the description of solids as NURBS patches and trimming curves defined in the local coordinate system of the patch. This information can then be used to trim the NURBS patch, i.e. to remove part of the patch surface to create for example a hole.

In this paper we present a simple but effective approach to trimming. To the best of our knowledge the proposed method of double mapping has not been published previously.

Furthermore we propose to generalize the isogeometric concept by approximating the boundary values (tractions, displacements) with functions that are different from the ones used to describe the geometry. Our motivation for this comes from the fact that

trimming curves obtained from CAD programs sometimes have high order and a high number of control points and this description of the geometry may not be suitable for describing the boundary values.

The paper will present the theoretical background and test examples that show that the approach is efficient and leads to accurate results. As a practical example we show a branched tunnel in an infinite domain.

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