The Isogeometric Nyström Method

J. Zechner*[†], B. Marussig[†], G. Beer[†,‡] and T. P. Fries[†]

[†] Institute of Structural Analysis
Graz University of Technology
Lessingstraße 25/II, 8010 Graz, Austria
e-mail: juergen.zechner@tugraz.at, web page: http://www.ifb.tugraz.at

[‡] Centre for Geotechnical and Materials Modeling
University of Newcastle
Callaghan, NSW 2308, Australia
web page: http://www.cgse.edu.au

ABSTRACT

The concept of isogeometric analysis [1] unifies computer methods of computer aided geometric design (CADG) and numerical analysis. Analysis on three dimensional design surfaces without the need of any domain discretization is possible for homogeneous problems by means of boundary integral equations (BIE). Therefore, the isogeometric boundary element method has gained much attention recently [2].

In this work, the authors present the application of the locally corrected Nyström method [3] to the isogeometric framework. The Nyström method is a higher order quadrature based method for the discretization of BIEs. In the context of CADG representations, only a valid geometric mapping of a reference element for the numerical quadrature is required. Hence, the method is applicable to trimmed and untrimmed NURBS, subdivision surfaces and T-splines in a straightforward way.

The proposed formulation uses NURBS surfaces which are the common geometry description in computer aided design. Entries in the system matrix consist of point-wise evaluations of the fundamental solution on the surface except for the singular diagonal ones. The regularization is carried out by means of b-spline basis functions. Moreover, local p- and h-refinement is possible also on tensor-product-based NURBS surface descriptions. In order to map the point-wise results to the surface, the formulation makes use of piece-wise Bézier elements.

The isogeometric Nyström method is applied to solve the Laplace and Lamé-Navier equation. The features and limitations of the proposed method is described and numerical results are shown in two and three dimensions.

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