Quadrature rules based on spline quasi-interpolation in IgA-BEM applications

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ABSTRACT

Boundary Element Methods (BEMs) are schemes studied since the mid '80s, for the numerical solution of those Boundary Valued Problems, which can be reformulated as a system of integral equations defined only on the boundary of the domain. These methods have two main advantages, the dimension reduction of the computational domain and the simplicity for treating external problems. One of the important challenges in this topic is to accurately and efficiently solve singular integrals that arise from the boundary integral equations so formulated. Therefore, designing suitable quadrature schemes is one of the main active research topic in BEM, [1].
Recently new quasi-interpolation (QI) based quadrature rules have been introduced specifically for IgA-BEM setting, [2]. Such quadrature schemes are tailored for B-splines and provide very good accuracy and optimal convergence rate. In this talk we show how weakly, strongly and hyper-singular integrals related to the 2D integral formulation of the Laplace equation with different types of boundary conditions can be approximated by using these new rules, exhibiting promising results. Moreover local refinability of the approximated solution of the problem is also addressed by using hierarchical B-spline spaces. It can be seen that the local nature of the QI perfectly fits with hierarchical spline constructions and leads to an efficient and accurate numerical scheme, [3].

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REFERENCES

[1] Aimi, A., Calabrò, F., Diligenti, M., Sampoli, M. L., Sangalli, G.and Sestini, A. Efficient assembly based on B-spline tailored quadrature rules for the IgA-SGBEM, *Comput. Methods Appl. Mech. Engrg.* (2018) **331**:327–342.

[2] Calabrò, F., Falini, A., Sampoli, M.L. and Sestini, A. Efficient quadrature rules based on spline quasi-interpolation for application to IGA-BEMs, *Journal of Comp. Appl. Math.* (2018) **338**:153–167.

[3] Falini, A., Giannelli, C., Kanduč, T., Sampoli, M.L. and Sestini, A. An adaptive IgA-BEM with hierarchical B-splines based on quasi-interpolation quadrature schemes, *Int. J. Numer. Methods Eng.* (2019) **117**(10):1038–1058.