A multi-patch IgA-BEM model for 3D Helmholtz problems

Antonella Falini[a], Tadej Kanduč[b], Maria Lucia Sampoli[c], Alessandra Sestini[d]

[a] Department of Computer Science, University of Bari (Italy)
[b] Faculty of Mathematics and Physics, University of Ljubljana (Slovenia)
[c] Department of Information Engineering and Mathematics, University of Siena (Italy)
[d] Department of Mathematics and Computer Science, University of Firenze (Italy)

e-mail antonella.falini@uniba.it, e-mail tadej.kanduc@fmf.uni-lj.si, e-mail marialucia.sampoli@unisi.it, e-mail alessandra.sestini@unifi.it

An Isogeometric Boundary Element Method (IgA-BEM) is considered for the numerical solution of Helmholtz problems on 3D domains admitting a smooth conformal multi-patch representation of the boundary surface. In particular, the resulting Boundary Integral Equations are discretized by a classical collocation method and a spline based quasi-interpolation quadrature scheme is developed for both regular and singular kernels. Suitable spline-product spaces are constructed locally on the support of every B-spline basis function and in case of singular (or nearly singular) integrals, a singularity extraction technique is combined with a an elegant recursive formula, which is based on the analytical evaluation of fundamental polynomial moments. Taking advantage of the local construction on each basis support, the matrix assembly phase can be efficiently carried out by using a function-by-function approach. Relevant benchmarks show that the expected convergence orders are achieved and good accuracy is reached by using a small number of quadrature nodes.