Isogeometric Boundary Element Methods

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We will introduce the concept of boundary element methods and explain how they can be formulated within the framework of isogeometric analysis for different problems. Boundary element methods reformulate certain problems, where we will consider Laplace, Helmholtz, or Maxwell problems as examples, in terms of integral equations on the boundary of a given domain. The induced problem requires the approximation of a density on the boundary; which must be investigated in so-called trace spaces, i.e., spaces induced by restricting the corresponding volumetric spaces to the boundary in a limit sense. However, the induced norms on the boundary are non-local, which poses certain problems: The convergence of boundary methods on locally nonsmooth domains can be impaired globally. This behaviour will be explained and investigated, both numerically and analytically. Moreover, since in industrial applications geometries of interest are seldom smooth, we will discuss the utilisation of higher order methods on such problems. This will be done through a set of numerical experiments, where we compare both isogeometric and classical higher-order methods.

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