An Interpolation-Based fast Multipole Method for Higher Order Boundary Elements on Parametric Surfaces

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We propose a black-box higher order fast multipole method for solving boundary integral equations on parametric surfaces in three dimensions. Such piecewise smooth surfaces are the topic of recent studies in isogeometric analysis. Due to the exact surface representation, the rate of convergence of higher order methods is not limited by approximation errors of the surface. An element-wise clustering yields a balanced cluster tree and an efficient numerical integration scheme for the underlying Galerkin method. By performing the interpolation for the fast multipole method directly on the reference domain, we reduce the cost complexity in the polynomial degree by one order. This gain is independent of the application of either $\mathcal{H}$- or $\mathcal{H}^2$-matrices. In fact, we point out several simplifications in the construction of $\mathcal{H}^2$-matrices, which are a by-product of the surface representation.

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