DENSITY INTERPOLATION METHODS FOR EVALUATION OF NEARLY-SINGULAR, WEAKLY-SINGULAR, AND HYPER-SINGULAR BOUNDARY INTEGRAL OPERATORS AND LAYER POTENTIALS

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Abstract. This talk presents ongoing work on a class of effective and simple-to-implement methods for the numerical evaluation of boundary integral operators and layer potentials in two and three spatial dimensions. These methods rely on the use of Green's third identity and local Taylor-like interpolations of density functions in terms of homogeneous solutions of the underlaying PDE. The proposed technique effectively regularizes the singularities present in boundary integral operators and layer potentials, and recasts the latter in terms of integrands that are bounded or even more regular, depending on the order of the density interpolation. The resulting boundary integrals can then be easily, accurately, and inexpensively evaluated by means of standard quadrature rules. A variety of numerical examples demonstrate the effectiveness of the technique in the context of Nyström and boundary element methods for the Laplace and Helmholtz equations.

Keywords: layer potentials, boundary integral operators, Taylor interpolation, Nyström method, boundary element method

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