Efficient and accurate computation of singular and near-singular integrals in high-order boundary elements

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Time-harmonic solutions to the wave equation are solutions to the Helmholtz equation $\Delta u + k^2 u = 0$, which is of fundamental importance in science and engineering. Its solutions may be expressed in terms of so-called layer potentials ; the differential equation is then replaced by a boundary integral equation, whose unknown is typically the jump in either the function or conormal derivative values across the boundary. Solutions at large wavenumbers k are highly oscillatory, and this causes a great increase in complexity of numerical algorithms aimed at solving the underlying integral equations. To obtain accurate solutions in this regime, it is necessary to use high-order numerical methods. In this talk, we present a novel method for computing singular and near-singular integrals arising in high-order boundary elements based on Taylor expansions, homogeneous functions and the continuation approach.

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