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NEW HIGH-ORDER, HIGH-FREQUENCY METHODS IN COMPUTATIONAL ELECTROMAGNETISM

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Abstract. *We present a new set of algorithms and methodologies for the numerical solution of problems of scattering by complex bodies in three-dimensional space. These methods, which are based on integral equations, high-order integration, fast Fourier transforms and highly accurate high-frequency methods, can be used in the solution of problems of electromagnetic and acoustic scattering by surfaces and penetrable scatterers–even in cases in which the scatterers contain geometric singularities such as corners and edges. In all cases the solvers exhibit high-order convergence, they run on low memories and reduced operation counts, and they result in solutions with a high degree of accuracy. In particular, our algorithms can evaluate accurately in a personal computer scattering from hundred-wavelength-long ob jects by direct solution of integral equations–a goal, otherwise achievable today only by supercomputing. A new class of high-order surface representation methods will be discussed, which allows for accurate high-order description of surfaces from a given CAD representation. A class of high-order high-frequency methods which we developed recently, finally, are efficient where our direct methods become costly, thus leading to a general computational methodology which is applicable and accurate for the whole range of frequencies in the electromagnetic spectrum.*