FIRST-ORDER SECOND MOMENT SPARSE TENSOR APPROXIMATION OF MAXWELL SCATTERING BY RANDOMLY SHAPED OBJECTS

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Abstract. For time-harmonic scattering of electromagnetic waves from scatterers with uncertain geometry, we perform a domain perturbation analysis. Assuming known statistics of the (small amplitude) random perturbations of the scatterers' (assumed known) nominal geometry, we derive a tensorized integral equation which describes, to leading order, the second order statistics (ie., the two-point correlation) of the random scattered electric field. Both, perfectly conducting as well as homogeneous dielectric scatterers with random boundary (resp. random interface) are considered. Deterministic tensor equations for second-order statistics of both, Cauchy data on the nominal domain of the scatterer as well as of the far-field pattern are derived, generalizing [1] to electromagnetics and to interface problems, and being an instance of the general programme outlined in [2]. The tensorized integral equations are boundary integral equations (BIEs) which are formulated on the nominal scatterer (whose geometry is assumed to be known). Sparse tensor Galerkin discretizations of these BIEs are proposed and analyzed; we show that they allow consistent Galerkin approximations of the complete second order statistics of the random scattered electric field, with computational work equivalent to that for the Galerkin solution of the nominal problem up to logarithmic terms [3].

References

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[1]Partially supported by Fondecyt Iniciación 11121166 and Anillo ANANUM, ACT1118, Conicyt, e-mail: `cjerez@ing.puc.cl`
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