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ASYMPTOTIC MODELING OF ELECTROMAGNETIC WAVE SCATTERING PROBLEMS BY SMALL SPHERES

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In the context of non-destructive testing in medical imaging or civil engineering, the detection of small heterogeneities can be a difficult task in three dimensional domains. The complexity for solving numerically direct problems both in terms of computation time and memory cost is due to the small size of obstacles in comparison with the incident wavelength and the large size of the domain of interest. Then the fine mesh size makes unsuitable or too expensive the use of classical numerical methods e.g. continuous and discontinuous finite element methods or boundary element methods. We are concerned by reduced models to solve the direct problem.

The use of reduced models allows to get an approximation of the exact solution at a certain accuracy with a lower cost. We develop a Matched Asymptotic Expansions method to solve a time-harmonic electromagnetic scattering problem by a small sphere perfectly conducting. This method allows to replace the scatterer by an equivalent asymptotic point source [2]. In practice, it consists in defining an approximate solution using multi-scale expansions over far and near fields, related in a matching area.

When the scatterer is a sphere, we make explicit the asymptotic expansions up to the second order relatively to the sphere radius. In a second time, we introduce some numerical results which make evident the order of convergence with respect to the sphere radius. The reference solutions are analytical solutions computed thanks to Montjoie code [1].

REFERENCES

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