Fast Solvers for Non-linear Time-harmonic Problems

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ABSTRACT

The talk starts with a general introduction to the basic problems in Computational Electromagnetics (CEM). In practical applications, the excitation is often time-harmonic. Switching from the time domain to the frequence domain allows us to replace the expensive time-integration procedure by the solution of a simple elliptic equation for the amplitude. This is true for linear problems, but not for non-linear problems. However, due to the periodicity of the solution, we can expand the solution in a Fourier series. Truncating this Fourier series and approximating the Fourier coefficients by finite elements, we arrive at a large-scale coupled non-linear system for determining the finite element coefficients of the Fourier coefficients. The construction of fast solvers for such systems is very crucial for the efficiency of this multi-harmonic approach. In this talk we look at non-linear, time-harmonic eddy current problems and at a simpler potential problem of the same structure. For the latter problem, we construct and analyse an almost optimal solver for the large-scale coupled system that one has to solve instead of performing the expensive time-integration procedure.

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References

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