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Fast multipole and space adaptive multiresolution methods for the solution of the Poisson equation PETR BILEK, Department of Physical Electronics, Faculty of Science, Masaryk University, Kotlarska 2, 61137 Brno, Czech Republic, MAX DUARTE, CD-adapco, 200 Shepherds Bush Road, London W6 7NL, UK, DAVID NEČAS, CEITEC, Masaryk University, Kotlarska 2, 61137 Brno, Czech Republic, ANNE BOURDON, LPP, UMR 7648, Ecole Polytechnique, route de Saclay, 91128 Palaiseau Cedex, France, ZDENĚK BONAVENTURA, Department of Physical Electronics, Faculty of Science, Masaryk University, Kotlarska 2, 61137 Brno, Czech Republic — This work focuses on the conjunction of the fast multipole method (FMM) with the space adaptive multiresolution (MR) technique for grid adaptation. Since both methods, MR and FMM provide a priori error estimates, both achieve O(N) computational complexity, and both operate on the same hierarchical space division, their conjunction represents a natural choice when designing a numerically efficient and robust strategy for time dependent problems. Special attention is given to the use of these methods in the simulation of streamer discharges in air. We have designed a FMM Poisson solver on multiresolution adapted grid in 2D. The accuracy and the computation complexity of the solver has been verified for a set of manufactured solutions. We confirmed that the developed solver attains desired accuracy and this accuracy is controlled only by the number of terms in the multipole expansion in combination with the multiresolution accuracy tolerance. The implementation has a linear computation complexity O(N).

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