# Recent advances in the spherical harmonics expansion of the Boltzmann transport equation

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Since typically employed macroscopic transport models are invalid in the deca-nanometer regime, accurate semiclassical simulation of carrier transport in semiconductors requires the solution of Boltzmann's transport equation. To overcome the deficiencies of stochastic Monte Carlo techniques, a deterministic solution approach based on a spherical harmonics expansion (SHE) has become increasingly attractive over the last years [1]. Unfortunately, the high computational effort of the SHE method has so far prevented its application to 3D geometries. We refine the SHE method by suggesting and evaluating adaptive variable-order expansions, a system matrix compression scheme for keeping the memory consumption at high expansion orders moderate, a parallel preconditioner for accelerating the solution of the resulting system of linear equations, and demonstrate an efficient implementation of the proposed algorithms on unstructured grids. The combination of these techniques allows for the efficient solution of higher-order expansions not only in low-dimensional devices, but also in the unchartered 3D regime.

1. Hong, S. M. and Jungemann C. 2011 *Deterministic Solvers for the Boltzmann Transport Equation.* Springer.