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Highly Oscillatory Integration and its Applications

The computation of highly oscillatory integrals is considered as a challenging problem, in particular in a multivariate setting. In the last few years a wide range of new approaches have been developed for this task: asymptotic, Filon-type, Levin-type and computational stationary phase techniques. They all share an important common denominator: very accurate computation of highly oscillatory integrals becomes relatively easy and the efficacy of all these techniques increases when oscillation becomes more rapid.

The accessibility of accurate quadrature of highly oscillatory integrals renders a wide range of applications feasible:

- The computation of highly oscillatory differential equations by integral-series methods in tandem with exponential integrators;
- Computation of integral equations occurring in electromagnetics; Rapid approximation of functions in DirichletNeumann bases;
- Solution of differential equations with stable spectral methods employing modified Fourier expansions;
- Computation of spectra of compact operators.