Numerical approximation of highly oscillatory integrals

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Abstract
Oscillatory integrals of the form $\int_{a}^{b} f(x) \exp(ikg(x)) \, dx$ regularly appear in applications. Their efficient and accurate computation for large values of the parameter $k$ has been a subject of substantial renewed research interest in recent years. This is because conventional numerical integration methods, based on approximation by piecewise polynomials, cope very badly when the integrand is highly oscillatory (which happens when $k$ is large). In this talk, a brief overview of numerical methods designed for computing oscillatory integrals will be given. One such method, Filon-Clenshaw-Curtis method, will be studied in more detail. In particular, very recent results on its explicit error bounds with respect to the parameter $k$, the parameters associated with the quadrature, and the regularity of $f$ (that may have integrable singularities) and $g$ (that may have stationary points), will be presented.