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Application of the Cauchy integral approach to singular and highly oscillatory integrals.
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Summary: This paper presents a method that is based on the sum of line integrals for fast computation of singular and highly oscillatory integrals

\[ \int_{c}^{d} G(x)e^{i\mu(x-c)}dx, \quad -\infty > c > d > \infty, \text{ and } \int_{-1}^{1} f(x)H_I(x)e^{i\mu x}dx, \]

where \( G \) and \( f \) are non-oscillatory sufficiently smooth functions on the interval of integration. \( H_I \) is a product of singular factors and \( \mu \gg 1 \) is an oscillatory parameter. The computation of these integrals requires \( f \) and \( G \) to be analytic in a large complex region \( C \) accommodating the interval of integration. The integrals are changed into a problem of integrals on \([0, \infty)\); which are later computed using the generalized Gauss-Laguerre rule or by the construction of Gauss rules relative to a Freud weights function \( e^{-x^k} \) with \( k \) positive. MATHEMATICA programming code, algorithms and illustrative numerical examples are provided to test the efficiency of the presented experiments.

MSC:
65D30 Numerical integration

Keywords:
highly oscillatory integrals; Gauss quadrature rules; numerical steepest descent method; Gauss-Laguerre quadrature rule; Chebyshev algorithm

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References:


[29] Rvachev, V. L., The pressure on an elastic half space of a beam which has the form of a strip, Prikl. Mat. Meck., 20, 248-256 (1956)


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