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Suitable Gauss and Filon-type methods for oscillatory integrals with an algebraic singularity.
(English) Zbl 1158.65019

Highly-oscillating integrals with an integrand of the form such as \( A(t) \exp(i\omega \phi(t)) \) are in the core of wide range of practical problems in many fields of fluid dynamics, quantum chemistry, and they have direct connection with Hilbert transform theory. It is to be noted that for large values of the frequency \( \omega \) traditional quadratures fail to approximate these integrals. In particular it appears to be a substantial issue to compute the integrals of the form \( \int_0^1 t^a f(t) \sin(\omega/t) \)dt.

In this work, two types of methods are developed to accurately complete them: the modified Filon method and Gauss quadrature rules based on specially selected weight functions. It is proposed to compute the special coefficients of the polynomials orthogonal with respect to these weight functions based on a Chebyshev algorithm using arbitrary precision arithmetic. Numerical examples are generated to test these methods.

Reviewer: Denis Sidorov (Irkutsk)

MSC:
65D32 Numerical quadrature and cubature formulas
41A55 Approximate quadratures

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References:
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