Zaman, Sakhi; Siraj-ul-Islam; Khan, Muhammad Munib; Ahmad, Intiaz

New algorithms for approximation of Bessel transforms with high frequency parameter.

Summary: Accurate algorithms are proposed for approximation of integrals involving highly oscillatory Bessel function of the first kind over finite and infinite domains. Accordingly, Bessel oscillatory integrals having high oscillatory behavior are transformed into oscillatory integrals with Fourier kernel by using complex line integration technique. The transformed integrals contain an inner non-oscillatory improper integral and an outer highly oscillatory integral. A modified meshfree collocation method with Levin approach is considered to evaluate the transformed oscillatory type integrals numerically. The inner improper complex integrals are evaluated by either Gauss-Laguerre or multi-resolution quadrature. Inherited singularity of the meshfree collocation method at \( x = 0 \) is treated by a splitting technique. Error estimates of the proposed algorithms are derived theoretically in the inverse powers of \( \omega \) and verified numerically.

MSC:
65Dxx Numerical approximation and computational geometry (primarily algorithms)
41Axx Approximations and expansions
65Txx Numerical methods in Fourier analysis

Keywords:
Bessel integral transforms; complex line integration; meshfree collocation method; Gauss-Laguerre and multi-resolution quadratures

Full Text: DOI

References:


