Computing double integrals with the numerical method of steepest descent

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ABSTRACT

A numerical method of integration in computerized tomography reconstructions and other applications is the application of integrals to solve, as given by the integral which is to be evaluated for stationary points. The method of steepest descent is shown to offer efficient evaluation of such integrals for most integral methods. The steepest descent method is a tool for the evaluation of asymptotic expansions of integrals. In stationary points of the integrand, the stationary point is a point at which the integrand is a maximum or a minimum.

The method of steepest descent is a tool for the evaluation of asymptotic expansions of integrals. In stationary points of the integrand, the stationary point is a point at which the integrand is a maximum or a minimum. The steepest descent method consists of deforming the original integration range on the real axis through a stationary point to an imaginary axis.

The new method has been implemented in the form of a C code. It has been shown that the accuracy of the new method decreases for low frequencies and for geometrical cases where the receiver point is near a zone boundary. Methods to tackle these limitations are outlined.

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Numerical examples

A few numerical examples are presented below. One of the infinite integrals has been chosen as a demonstration case, i.e., the Gaussian parameter (\sigma = 2) was chosen so that the infinite integrals can be evaluated with the new method. The infinite integrals were chosen so that they could be evaluated with the new method. The infinite integrals were chosen so that they could be evaluated with the new method.

Several integrals have been chosen to demonstrate the effectiveness of the method. These integrals have been chosen so that they could be evaluated with the new method. The infinite integrals were chosen so that they could be evaluated with the new method. The infinite integrals were chosen so that they could be evaluated with the new method.

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The high accuracy and efficiency of a new numerical method for solving diffraction integrals is demonstrated. Special care needs to be taken for receiver positions that are close to the zone boundaries. Furthermore, the regime of resonance results in larger for lower frequencies. The number of quadrature points has a strong influence on the accuracy near the boundaries. An observed effect in [29] is that small ranges could be treated separately, either using another quadrature method or by using an analytical approximation as in [32]. Yet another possibility to tackle the problem is the area around the zone boundaries is to apply generalized Gaussian quadrature, as in [29], for this specific integral.

REFERENCES