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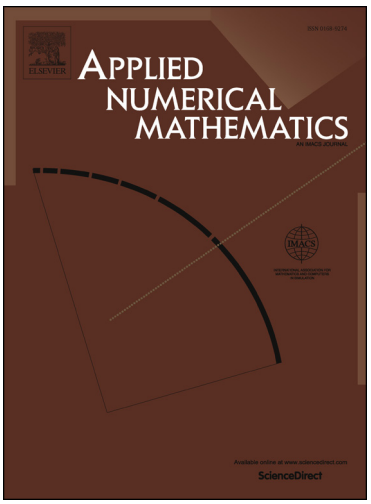

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A sampling-based approximation of the complex error function and its implementation without poles

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Abstract

Recently we developed a new sampling methodology based on incomplete cosine expansion of the sinc function and applied it in numerical integration in order to obtain a rational approximation for the complex error function $w(z) = e^{-z^2}\left(1 + \frac{2i}{\sqrt{\pi}}\int_0^z e^{t^2}dt\right)$, where $z = x + iy$. As a further development, in this work we show how this sampling-based rational approximation can be transformed into alternative form for efficient computation of the complex error function $w(z)$ at smaller values of the imaginary argument $y = \mathrm{Im}[z]$. Such an approach enables us to avoid poles in implementation and to cover the entire complex plain with high accuracy in a rapid algorithm. An optimized Matlab code utilizing only three rapid approximations is presented.

Keywords: complex error function; rational approximation; sampling; sinc function

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