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Monotonicity Results for a Compound Quadrature Method for Finite-Part Integrals

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Abstract:

Given a function $f \in C^3[0,1]$ and some $q \in (0,1)$, we look at the approximation for the Hadamard finite-part integral $=\!\!\!\!\!\!\int_0^1 x^{-q-1} f(x)dx$ based on a piecewise linear interpolant for f at n equispaced nodes (i.e., the product trapezoidal rule). The main purpose of this paper is to give sufficient conditions for the sequence of approximations to converge against the correct value of the integral in a monotonic way. An application of the results yields detailed information on the error term of a backward differentiation formula for a fractional differential equation.