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Fred J. Hickernell* (hickernell@iit.edu), E1-208, 10 W. 32nd Street, Department of Applied Mathematics, Illinois Institute of Technology, Chicago, IL 60616. *Guaranteed Adaptive, Automatic, Quadrature.*

Automatic quadrature algorithms claim to provide an approximation to the integral that is within a user-specified error tolerance of the true integral. Most comprehensive numerical computing environments, such as MATLAB, Chebfun, Mathematica, NAG, and R, include automatic quadrature algorithms. Typically, these algorithms are adaptive, meaning that they adjust their computational effort based on the perceived difficulty of the problem. Unfortunately, these adaptive algorithms come with no guarantees, i.e., sufficient conditions on the integrands ensuring that the algorithm works as advertised. Here we describe an adaptive trapezoidal algorithm for integration that is guaranteed to provide the correct answer for cones of integrands. The computational cost has optimal convergence order. This new algorithm has consequences for how numerical quadrature should be taught. It also illustrates a new paradigm for constructing adaptive, automatic numerical algorithms. (Received September 05, 2013)