Approximation of Functions and Solutions to Ordinary Differential Equations by Adaptive Poly-Sinc Methods

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We propose an adaptive method based on Poly-Sinc approximation to approximate functions and to solve ordinary differential equations (ODEs). Poly-Sinc approximation is a Lagrange interpolation scheme in which non-equidistant points generated by conformal mappings are used. These non-equidistant points are called Sinc points, which are characterized by their dense distribution near the endpoints of a finite interval. We discuss the error analysis of the adaptive Poly-Sinc approximation and show that the algorithm has a convergence rate of exponential order. We test the adaptive Poly-Sinc approximation on continuous functions and functions with singularities at the endpoints of a finite interval.

We also propose an adaptive Poly-Sinc-based collocation method to approximate solutions to ODEs. We test the adaptive collocation method on ODEs whose exact solution exhibits a singularity at one endpoint of a finite interval and singular ODEs whose exact solution is a continuous function on a finite interval.