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Reconstructing the piecewise-smooth solution of the Poisson equation for Chebyshev-collocation solution with pointwise exponential convergence SUDIPTA RAY, SANDEEP SAHA, Department of Aerospace Engineering, Indian Institute of Technology — Computation of an exponentially accurate solution of the Poisson equation which is discontinuous across an interface is restricted by the occurrence of the *Gibbs phenomenon*. Spectral discretization with inaccurate implementation of the jump conditions produces aphysical oscillations in the numerical solution with algebraic convergence. In the present work, a Chebyshev-collocation spectral discretization is implemented to compute the piecewise-smooth solution of the Laplace and the Poisson equation in two dimensions, where the solution domain contains an interface of complex geometrical shape. The solution is expressed as the sum of a smooth function and a modified Heaviside function at the interface. The unit Heaviside step function is weighted by a smooth jump function which allows the conditions at the interface to be imposed exactly. The modified Heaviside function for interface conditions on the solution and the gradient along the normal is expressed with a weak form expansion. In the presence of global information on the jumps in the form of analytical expressions, the method demonstrates pointwise exponential convergence for the problems considered. In addition, the method appears to be insensitive to perturbations to the interface below the local grid spacing.

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