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Exponentially-accurate Chebyshev-collocation methods for elliptic and parabolic differential equations with complex interfacial geometries SUDIPTA RAY, SANDEEP SAHA, Indian Institute of Technology Kharagpur — We present a Chebyshev-collocation method for obtaining the piecewise-smooth solution of parabolic and elliptic partial differential equations. Spectral discretization of a piecewise-smooth solution leads to *Gibbs oscillations* around the interface of discontinuity, leading to large discretization errors. We reconstruct the solution as the sum of a smooth function and a weighted Heaviside function. The jump conditions at the interface are utilized to formulate a smooth correction function for weighing the Heaviside function. The correction function is presented using a weak-form representation. The use of the interface jump condition to form the correction function ensures that the conditions at the interface are satisfied exactly. The approach requires global information of the discontinuities; the interface conditions are obtained by assuming smooth extension of the solution in one domain into the other. The two and three-dimensional Poisson equation and the one-dimensional Stefan problem are solved using the weak-formulation and exponential convergence is achieved in both the cases. A grid sensitivity analysis shows that the method is insensitive to sub-grid scale perturbations to the interface location.

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