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Overlapping localized exponential time differencing methods for reaction-diffusion equations.

The localized exponential time differencing (ETD) method based on overlapping domain decompositions has been recently introduced and successfully applied to the parallel computations for extreme-scale numerical simulations of coarsening dynamics based on phase field models. In this talk, we focus on a class of reaction-diffusion equations within the well-known Allen-Cahn equation as a special case. We first present the space-discrete systems under the standard central difference discretization and prove the equivalence of the multidomain and the monodomain problems. Then, we apply the ETD schemes to the semi-discrete subdomain problems to obtain the fully discrete localized ETD schemes and prove the convergence of the fully discrete solution to the exact semi-discrete solution. Finally, we show some numerical experiments to verify the theoretical results in 1-D space and compare the efficiency of the proposed schemes with different numbers of subdomains in 2-D case. (Received January 26, 2019)