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*On fast multiscale algorithms incorporating FFT and domain decomposition*

We present fast spectral algorithms for the solution of elliptic partial differential equations (the Poisson equation, the Helmholtz and the modified Helmholtz equations) which may involve decomposition of the original domain. In each subdomain, the solution is based on the application of the Fast Fourier Transform. The ways to handle the Gibbs phenomenon (including 2-D and 3-D domains) are discussed. One of the methods is based on the eigenfunction expansion of the right hand side with successive integration combined with a subtractive technique.