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Local Fourier analysis for model transport problems

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Monte Carlo methods are typically used for simulations of the forward-peaked scattering behavior of electron beams in radiation therapy. Grid-based discretizations, however, can provide more efficient simulations if optimal solvers can be found for the resulting linear systems. The multigrid method for model two-dimensional transport problems as presented in [Börgers and MacLachlan, An angular multigrid method for computing mono-energetic particle beams in Flatland, J. Comp. Phys., 229 (2010), pp. 2914-2931] shows good performance with some dependence on the choice of scattering kernel. In order to understand this behavior local Fourier analysis can be applied to the two-grid cycle. Using this approach, expressions for the error-propagation operators of the coarse-grid correction and relaxation projected onto the fine-grid harmonic spaces can be found. In this talk, we discuss progress to date in applying local Fourier analysis to model two-dimensional transport problems.