Some challenging issues in the linear algebra of contour integral methods for PDEs

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We generalize ideas in the recent literature [1] and develop new ones [2] in order to propose a general class of contour integral methods for linear convection–diffusion PDEs and in particular for those arising in finance. These methods aim to provide a numerical approximation of the solution by computing its inverse Laplace transform. The choice of the integration contour is determined by the computation of a few suitably weighted pseudo-spectral level sets of the leading operator of the equation, defined as:

$$\sigma_{\epsilon,t}(A) = \left\{ z \in \mathbb{C} : e^{-\Re(z)t} \sigma_{\min}(A - zI) \leq \epsilon \right\}. \quad (2)$$

A fast and reliable approximation of these weighted pseudo-spectral level sets is fundamental for the use of contour integral methods. We propose a new fast pseudospectral roaming method and we show results of its application in some illustrative parabolic problems.

Joint work with N. Guglielmi and M. López Fernández

References
