Identifying discontinuity in real inversion of the Laplace transform with the Tikhonov regularization method

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Abstract

In this presentation, we shall give an example of identification of discontinuity of a function with the Tikhonov regularization, in problems of the real inversion of the Laplace transform. The proposed method bases on the theory of reproducing kernel Hilbert space (RKHS) with a suitable norm. We have established the real inversion formula of the Laplace transform using a Fredholm integral equation of the second kind.

In the regularization method, we approximate an original function by absolutely continuous functions in the RKHS. We must choose quite small regularization parameters to obtain good approximations, especially the original function has the discontinuity. Though the regularized equations is well-posed in the sense of Hadamard by virtue of the regularization, its discretization scheme is numerically unstable (ill-conditioned) for small regularization parameters. To overcome the instability, we take multiple-precision arithmetic to reduce the influence of the rounding error with high-accurate numerical integration rules.