Regularized inversion of real-valued Laplace transforms

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Laplace transformation is used in solving different problems arising from various spheres of science and engineering. Simple image functions can be treated with the help of transform tables or by analytical evaluation of Laplace inversion contour integral. In case when Laplace transform has been obtained numerically or from an experiment a numerical inversion becomes the only way to find required solution. In many cases a Laplace transform is known only on the real axis.

The problem of real-valued Laplace transforms inversion is a well known ill-posed problem . The main approach in solving ill-posed problems is regularization.

There is a number of methods that use regularization. However, in all known regularization methods of Laplace inverse transformation the regularization step follows by other transformation such as discretization or decomposition into a series of orthogonal polynomials. That is regularization is applied to a second-order problem, not to a problem of inverting of real-valued Laplace transforms itself. In this case it turns out to be impossible to determine restrictions and limitations of a proposed method differently than by caring out an actual implementation of the method on a subset of Laplace transforms.

In this paper Laplace inverse regularizing operators are obtained directly from the Laplace transformation definition. First we introduce a regularizing transformation.

Next the main formula is derived. In the last section the theoretical error analysis is given. It reveals advantages and limitations of the proposed method and reflects

some general features of any method of inversion of real-valued Laplace transforms.