Numerical Applications of Tikhonov Regularization for the Fourier Multiplier Operators

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Abstract : Tikhonov regularization and reproducing kernels are the most popular approaches to solve ill-posed problems in computational mathematics and applications. And the Fourier multiplier operators are an essential tool to extend some known linear transforms in Euclidean Fourier analysis, as: Weierstrass transform, Poisson integral, Hilbert transform, Riesz transforms, Bochner-Riesz mean operators, partial Fourier integral, Riesz potential, Bessel potential, etc. Using the theory of reproducing kernels, we construct a simple and efficient representations for some class of Fourier multiplier operators T_m on the Paley-Wiener space H_h. In addition, we give an error estimate formula for the approximation and obtain some convergence results as the parameters and the independent variables approaches zero. Furthermore, using numerical quadrature integration rules to compute single and multiple integrals, we give numerical examples and we write explicitly the extremal function and the corresponding Fourier multiplier operators.

Keywords : fourier multiplier operators, Gauss-Kronrod method of integration, Paley-Wiener space, Tikhonov regularization

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