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A regularization framework for mildly ill-posed problems connected with pseudo-differential operator

Xiangtuan Xiong[a], E Zhuang[a], Xuemin Xue[a], Zhi Qian[b*]

a. Department of Mathematics, Northwest Normal University, Lanzhou, Gansu, China

b. Department of Mathematics, Nanjing University, Nanjing, Jiangsu, China

Abstract

Recently filter-based regularization methods have been well investigated for ill-posed problems when the forward operators are compact. There are many ill-posed problems connected with pseudo-differential operators. But there is no uniform method for this kind of problems. The work on generalization of filter-based regularization methods to pseudo-differential operator is necessary. In this paper, we present a regularization framework for solving the mildly ill-posed problems involved pseudo-differential operators. A general regularization method for this kind of problems is given. The order-optimal error estimates are derived under the usual source conditions. As an example, a new fractional Tikhonov regularization method could be cast into the general framework. Numerical experiments are conducted for showing the validity of the new fractional Tikhonov method.

Keywords: Ill-posed problems; fractional Tikhonov regularization; error estimate; pseudo-differential operator

AMS Subject Classification: 65R35, 53C35, 22E46

1 Introduction

Many inverse problems arising from mathematical physics are defined in infinite domain or semi-infinite domain. These problems can be formulated as the operator

*Corresponding to: xiongxt@gmail.com; xiongxt@fudan.edu.cn

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