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Sampling and quasi-optimal approximation for signals in a reproducing kernel space of homogeneous type

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Abstract: This paper considers the reconstruction of signals in a reproducing kernel space of homogeneous type from finite samples. First, a pre-reconstruction operator based on finite samples and probability measure is proposed and its bounded property is studied. Secondly, the stability and an iterative algorithm with exponential convergence are established for sampling and recovering signals in a subspace of homogeneous reproducing kernel space. Then, we show that the proposed algorithm also provides a quasi-optimal approximation to signals in a reproducing kernel space of homogeneous type. Finally, some numerical simulations are given to reconstruct signals on an interval.

Keywords: average sampling; quasi-optimal approximation; homogeneous type; reproducing kernel space; iterative algorithm

MR(2000) Subject Classification: 94A20, 46E22.

1 Introduction

Sampling and reconstruction of signals is significant for signal processing. Many results have been established for sampling and reconstructing signals to live in various spaces such as bandlimited spaces [1, 2], shift-invariant spaces [3, 4, 5] and reproducing kernel spaces [6, 7, 8, 9]. In order to accommodate a large number of possible signal models, sampling problem in reproducing kernel spaces of homogeneous type has received more attention in recent years [10, 11], but the sampling set is still relatively-separated. The problem how to find a reasonable approximation from finite samples is important in lots of applications, it was recently studied in [12] for bandlimited signals and in [13] for signals in a reproducing kernel subspace. In this paper, we will consider finite sampling and reconstruction of signals in a reproducing kernel space of homogeneous type. This extension from Euclidean space to a space of homogeneous type could have potential applications, such as for periodic signals and signals on a graph etc.

Let X be a set and $\rho : X \times X \rightarrow [0, +\infty)$ be a quai-metric on X ,

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