A Sampling Theorem for Fractional Wavelet Transform with Error Estimates

Abstract:

As a generalization of the ordinary wavelet transform, the fractional wavelet transform (FRWT) is a very promising tool for signal analysis and processing. Many of its fundamental properties are already known, however, little attention has been paid to its sampling theory. In this paper, we first introduce the concept of multiresolution analysis associated with the FRWT, and then propose a sampling theorem for signals in FRWT-based multiresolution subspaces. The necessary and sufficient condition for the sampling theorem is derived. Moreover, sampling errors due to truncation and aliasing are discussed. The validity of the theoretical derivations is demonstrated via simulations.