PREFACE

The pseudo-differential operator is an important tool, which is the generalization of the partial differential operator and useful to find the solution of the partial differential equation. Wavelet transform is an integral transform, whose kernel contains the translation and dilation in the time domain. A wavelet transform gives local as well as global information of a signal. This thesis consists of five chapters. In this thesis, we have considered different aspects, which are given below chapterwise.

Chapter 1 is introductory, which provides the historical background of the fractional Fourier transform, pseudo-differential operators, and wavelet transform. Definitions and properties of the Schwartz space, dual of Schwartz space, fractional operators, Lizorkin space, fractional Fourier transform, pseudo-differential operators, continuous fractional wavelet transform, Hankel transform and others are given.

Chapter 2 describes about the convolution property, Plancherel formula and continuity properties on $S(\mathbb{R}^n)$, and $S^{'}(\mathbb{R}^n)$ by using the n-dimensional fractional Fourier transform and its inversion formula. Boundedness of pseudo-differential operators on $S(\mathbb{R}^n)$, $S^{'}(\mathbb{R}^n)$, and Sobolev space are proved by exploiting the theory of the n-dimensional fractional Fourier transform. Applications of pseudo-differential operators are given in the Lizorkin space by using the Riemann-Liouville fractional derivative, and integral operators.

In Chapter 3, Abelian theorems for the fractional wavelet transform are obtained in classical and distributional sense both. An application and justification of Abelian theorems for the continuous fractional wavelet transform is given by using Mexican hat wavelet function.

In Chapter 4, the fractional Hankel transform is introduced by using the n-dimensional fractional Fourier transform of radial function. Parseval formula and various properties of the fractional Hankel convolution are discussed by using the technique of the fractional Hankel transform.

In Chapter 5, the fractional Bessel wavelet transform is introduced and obtained its inversion formula by exploiting the theory of the fractional Hankel transform. Boundedness properties and Calderon reproducing formula for the fractional Bessel wavelet transform are proved. Applications of the fractional Bessel wavelet transform associated with certain weighted Sobolev-type space are given. The time-invariant linear filter is expressed in the form of the fractional Bessel wavelet transform. With the help of aforesaid transform, the solution of the Fredholm integral equation is obtained.