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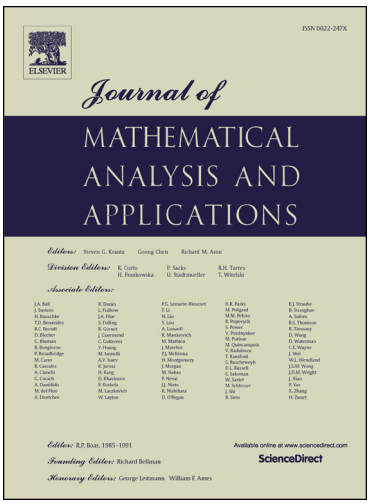

Existence and regularity of linear nonlocal Fokker–Planck equation with growing drift

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Existence and regularity of linear nonlocal Fokker-Planck equation with growing drift

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Abstract

The nonlocal Fokker-Planck equations for a class of stochastic differential equations with non-Gaussian $\alpha-$stable Lévy motion in Euclidean space are studied. The existence and uniqueness of weak solution are obtained with rough drift. The solution is shown to be smooth on spatial variable if all derivatives of the drift are bounded. Moreover, the solution is jointly smooth on spatial and time variable if we assume further that the drift grows like a power of logarithm function at infinity.

Keywords:
Fractional Laplacian operator, Non-Gaussian Lévy noise, Nonlocal Fokker-Planck equation

1. Introduction

In this work, we consider the following nonlocal Fokker-Planck (NFP) equation defined on $\mathbf{R}^n$

$$\begin{cases} u_t + \Lambda^\alpha u + \nabla \cdot (\boldsymbol{a}(x)u) = 0, \\ u(0,x) = u_0(x), \end{cases} \tag{1.1}$$

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