

**Title** : Pricing Exotic Options Under Levy Process and its Closed-form Solutions

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Path-dependent exotic options are contracts which are traded in financial markets, characterized by payoffs which are a function of the particular continuous path that asset prices follow over the life of the relevant option. Pricing such exotic options assuming that stock price follows Jump process such as Levy has been the main point of interest for financial analyst and researcher for many years. This is because, the stock price distribution indicate heavy tails.

A known class of Levy process called NIG shows very close fit and therefore there is a huge interest in research community to develop an arbitrage-free pricing method for the most popular path dependent exotic options such as Asian, Barrier and Look-back with such a process. Unfortunately, there are two major difficulties in arbitrage-free pricing of exotic options with Levy process. Firstly, the derivation of the closed-form pricing expression as the distribution of the payoff function is unknown when stock price follows exponential Levy process. Secondly, the estimation of risk neutral density from the market prices through calibration methods.

The most common approach for pricing exotic options is by numerical methods such as Monte-Carlo simulation. The main reason for adopting numerical methods is that the closed-form expression is very hard to derive for options with nonlinear payoff functions under a generic class of Levy process, especially when the distribution of payoff function is unknown. Unfortunately, the simulation methods are difficult and computationally expensive in many cases, and also quite involved. In order to address these challenges, we have proposed a novel approach for finding an arbitrage-free pricing expression (closed-form ) for pricing and proposed a method based on optimal control theory to estimate risk neutral density from the market prices available.

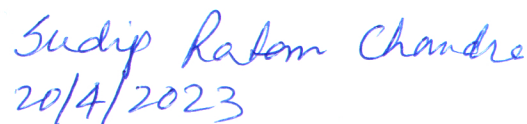
We propose a Partial Integro Differential Equations (PIDE) and closed-form Fourier Pricing formule for several Exotic options when stock price follows exponential Levy Process. We first develop a PIDE based on Martingale method and derive closed-form Fourier formula for pricing contracts. The pricing expressions are simple, easy to compute and works for wide class of Levy Processes.

**Signature of Supervisor**



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