An Extended Model of Asset Price Dynamics
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Financial derivatives are financial instruments whose values are derived from values of some other quantities. Imagination is the only limit as to what these "other quantities" may be. They can be other financial instruments (cash, bonds, stocks, options, interest rates, foreign currencies, foreign currency exchange rates), valuable metals like gold, agricultural products like wheat, weather condition, amount of rainfall in a certain specified geographical region during a certain specified time interval, result of a sports match, etc.

Following a survey of computational finance and wavelet analysis, an extended model of asset price dynamics for modeling stochastic upward and downward jumps in asset prices has been developed, and the modified Black-Scholes solution for value of vanilla options has been derived. As expected, the result of incorporating stochastic jumps is increase in volatility of asset price. This change in volatility has been precisely identified using the Itô integrals and Itô formulas.

Then a Monte Carlo simulation of asset and option prices has been performed, and the results have been investigated by applying wavelet analysis with different wavelet functions. Certain wavelet functions have been found to be more capable of detecting jumps in option prices than others.