1099-65-27   **Treena S. Basu*** (`treena.basu@gmail.com`), 2000 North Parkway, Department of Mathematics and Computer Scienc, Rhodes College, Memphis, TN 38112. *Fast Solution Methods for the Fractional Diffusion Equation and Its Application in Mathematical Finance.* Preliminary report.

Fractional diffusion equations model phenomena exhibiting anomalous diffusion that can not be modeled accurately by the second order diffusion equations. Because of the non-local property of fractional differential operators, the numerical methods have full coefficient matrices which require storage of $O(N^2)$ and computational cost of $O(N^3)$, where N is the number of grid points.

Together we develop a fast finite difference method for the one-dimensional space and time fractional diffusion equation, which only requires storage of $O(N)$ and computational cost of $O(N \log N)$, while retaining the same accuracy and approximation property as the regular finite difference method. Numerical experiments are presented to show the utility of the method.

For example, with 1024 computational nodes, the new scheme developed for the one-dimensional problem has about 40 times of CPU reduction than the standard scheme.

This work introduces a new financial risk assessment model based on Lévy statistics and considers a financial forecasting system that uses a solution to a non-stationary fractional diffusion equation characterized by the Lévy index. (Received December 17, 2013)