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Fractional Pearson Diffusion

Abstract

This is a joint work with Mark M. Meerschaert and Alla Sikorskii (Michigan State University).

Pearson diffusions have stationary distributions of Pearson type. They includes Ornstein-Uhlenbeck, Cox-Ingersoll-Ross, and several others processes. Their stationary distributions solve the Pearson equation, developed by Pearson in 1914 to unify some important classes of distributions (e.g.,normal, gamma, beta, reciprocal gamma, Student, Fisher-Snedecor). Their eigenfunction expansions involve the traditional classes of orthogonal polynomials (e.g., Hermite, Laguerre, Jacobi), and the finite classes of orthogonal polynomials (Bessel, Routh-Romanovski, Fisher-Snedecor).

We develop fractional Pearson diffisions, constructing by a non-Markovian inverse stable time change. Their transition densities are shown to solve a time-fractional analogue to the diffusion equation with polynomial coefficients. Because this process is not Markovian, the stochastic solution provides additional information about the movement of particles that diffuse under this model.

Anomalous diffusions have proven useful in applications to physics, geophysics, chemistry, and finance.

References

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