hp-DGFEM for Kolmogorov-Fokker-Planck Equations of Multivariate Lévy Processes

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Abstract We analyze the discretization of non-local degenerate integrodifferential equations arising as so-called forward equations for jump-diffusion processes, in particular in option pricing problems when dealing with Lévy driven stochastic volatility models. Well-posedness of the arising equations is addressed. We develop and analyze stable discretization schemes. The discontinuous Galerkin (DG) Finite Element Method is analyzed. In the DG-FEM, a new regularization of hypersingular integrals in the Dirichlet Form of the pure jump part of infinite variation processes is proposed. Robustness of the stabilized discretization with respect to various degeneracies in the characteristic triple of the stochastic process is proved. We provide in particular an *hp*-error analysis of the DG-FEM and numerical experiments.
Keywords: Discontinuous Galerkin Methods, Feller-Lévy processes, Pure jump processes, Lévy Copulas, Option pricing, Dirichlet Forms, Error analysis

References

[1] Marazzina D., Reichman O., and Schwab Ch., *hp-DGFEM for Kolmogorov-Fokker-Planck equations of multivariate Lévy Processes*, ETH Research Report No. 2011-17, 2011.