INTERNATIONAL BIWEEKLY ONLINE SEMINAR ON ANALYSIS, DIFFERENTIAL EQUATIONS AND MATHEMATICAL PHYSICS

Coordinators: Prof. Alexey Karapetyants, Prof. Vladislav Kravchenko

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30 November 2023, 6 pm (UTC+3)

Subordination principle, stochastic solutions and Feynman-Kac formulae for generalized time fractional evolution equations

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We consider generalized time-fractional evolution equations of the form $u(t) = u_0 + \int_0^t k(t,s)Lu(s)ds$ with a fairly general memory kernel k and an operator L being the generator of a strongly continuous semigroup (on some Banach space). In particular, this class of evolution equations includes time- and space- fractional heat and Schrödinger type equations, as well as many equations with Caputo type time-fractional derivatives. Some of these equations are used in models of anomalous diffusion. We show that the subordination principle holds for such evolution equations. This allows to obtain solutions of these equations via solutions of the corresponding "classical" equations (with the same L and $k \equiv 1$). We discuss different classes of stochastic processes which can be used to represent solutions of these equations (such processes are called "stochastic solutions"). We obtain Feynman-Kac formulae for solutions of some of these equations with the use of subordinate Markov processes and randomly scaled Gaussian processes. In particular, we obtain some Feynman-Kac formulae with generalized grey Brownian motion and other related self-similar processes with stationary increments.

References

[1] Ch. Bender, M. Bormann, Ya.A. Butko. Subordination principle and Feynman-Kac formulae for generalized time-fractional evolution equations. Frac. Calc. Appl. Anal. 25(4), 1818–1836, 2022.
[2] Ch. Bender, Ya.A. Butko. Stochastic solutions of generalized timefractional evolution equations. Frac. Calc. Appl. Anal. 25(2), 488–519, 2022.

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