Analysis of parabolic equations with singular potentials in Kondratiev spaces of generalized stochastic processes

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Abstract. Stochastic parabolic equations with singular potentials arise in probabilistic modelling of uncertainty in engineering and science, for example in structural mechanics, material science, fluid dynamics, climate and turbulence modelling. In this talk we consider stochastic parabolic problems of the form

$$\partial_t U - \mathcal{L}U + Q \cdot U = F, \quad U|_{t=0} = G, \tag{1}$$

where the potential Q, the driving force F and the initial data G are generalized stochastic processes of Kondratiev type. The focus is mainly on all possible singular behaviors of potential Q, either in space and time or in random component, but also in investigation possibilities to allow for irregular coefficients in the operator $\mathcal{L}$. The product $\cdot$ in above equation we interpret as the Wick product, which is introduced to give sense to the multiplication of two generalized stochastic processes, see [1]. In the analysis of these problems we combine the chaos expansion method from the white noise analysis and the concept of very weak solutions. The notion of a stochastic very weak solution of (1) is introduced and existence of unique very weak solution is proved. The questions on consistency of the stochastic very weak solutions with classical solutions are discussed.

The talk is based on recent papers [2, 3] and ongoing research.

Keywords: parabolic equations; stochastic parabolic equations; singular potentials; chaos expansions; very weak solutions.

References

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[2] **S. Gordić, T. Levajković, Lj. Oparnica.** Stochastic parabolic equations with singular potentials. *Chaos, Solitons & Fractals*, 2021, 151, 111245.

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