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Maria Curie-Skłodowska University in Lublin
Joanna Barańska

The Markov jump dynamics in the continuum

The thesis deals with Markov jump dynamics of infinite particle systems placed in $\mathbb{R}^d$, $d \geqslant 1$. The set of all locally finite subsets of $\mathbb{R}^d$ is used as the space of "pure" states. In a standard way, the configuration set is equipped with a σ-field of subsets which allows one to employ probability measures as states of the systems. The evolution of such states is then defined with the help of evolution equations – Kolmogorov and Fokker-Planck ones.

Systems of three types are considered. The first one is the model of free jumps, in the course of which each particle performs a random jump from point $x \in \mathbb{R}^d$ to point $y \in \mathbb{R}^d$ with the intensity that does not depend of the rest of the particles in the system. For this model, I show the existence of a global in time solution of the evolution equation for correlation functions. From this evolution, I also deduce the evolution of the corresponding states that preserves the class of sub-Poisson measures, which is interpreted as the lack of dense "clouds" of particles that may appear in the course of the evolution. The considered here evolution equation is formulated in an L^∞-type Banach space since the sub-Poissonian measures have their correlation functions belonging to such spaces. In view of this, I elaborate a special technique as usual semigroup methods are not directly applicable here. The second considered case is the Kawasaki model that also describes random jumps in $\mathbb{R}^d$. However, in this case the particle repel each other. For this model, I show the existence of the global evolution of correlation functions and of the corresponding states, that preserves the class of sub-Poissonian measures. In view of the interactions present in the system, I perform this in a different way as compared to the case of free jumps. To this end I use scales of Banach spaces as well as a specially elaborated technique based on the Thieme - Voigt perturbation theory and the Denjoy-Carleman theorem. In the contrast to the previous two, the third model is introduced in the thesis. This is a jump dynamical version of the Widom-Rowlinson model that describes two infinite systems of jumping point particles places in $\mathbb{R}^d$. The particles of different types repel each other whereas those of the same type do not interact. As in the case of the Kawasaki model, I construct the evolution of correlation functions and of the corresponding states. Additionally, for this model I describe a mesoscopic limit evolution based on the corresponding scaling and a kinetic equation derived therefrom. The results contained in the thesis were published in

- J. Barańska, Yu. Kozitsky, A Widom-Rowlinson jump dynamics in the continuum, *J. Dynam. Differential Equations* (2016) DOI 10.1007/s10884-016-9565-z.
- J. Barańska, Yu. Kozitsky, Free jump dynamics in continuum, *Contemporary Mathematics* **653** (2015) 13–23.
- J. Barańska, Yu. Kozitsky, The global evolution of states of a continuum Kawasaki model with repulsion, *IMA Journal of Applied Mathematics* (2018) DOI: 10.1093/imamat/hxy006.

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