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Oberseminar im Institut für Angewandte Analysis

Sommersemester 2025

Im Rahmen des Oberseminars spricht am Montag, den **14. Juli 2025**:

Alexander Braun

Multicomponent coagulation equation and rouleaux formation

In the first part, we study the cluster coagulation equation introduced by Norris [2] for a broad class of coagulation kernels. The cluster coagulation equation is a multicomponent coagulation equation and generalises Smoluchowski's coagulation equation. It is given by the equation

$$\langle f, \mu_t \rangle = \langle f, \mu_0 \rangle + \int_0^t \langle f, L(\mu_s) \rangle ds \tag{1}$$

with

$$\langle f, L(\mu) \rangle := \frac{1}{2} \int_{E\times E\times E} [f(z) - f(x) - f(y)] K(x, y, dz) \mu(\mathrm{d}x) \mu(\mathrm{d}y).$$

We present the strategy to prove existence and uniqueness of measure-valued solutions to (1). The proof is based on a truncated version of (1), where we only consider clusters with mass in a compact set $B \subset (0,\infty)$. An additional intensity parameter λ is introduced to approximate the coagulation rate between clusters with mass in B and clusters with mass in B^c.

In the second part, we introduce a new model to describe the formation of rouleaux in blood. Each rouleau is characterised by its size and certain topological properties. These are summarised in the triple $(c, a, l) \in \mathbb{N}_{\geq 2} \times \mathbb{N}_{\geq 0} \times \mathbb{N}_{\geq 1}$, where $a+2c = l+3$. We consider different types of coagulation processes between rouleaux. Based on Bertoin [1], we outline the idea of the proof for existence and uniqueness of C^1-solutions to the Arm-Arm coagulation equation, assuming initial concentrations of the form $\delta_{\{c=2\}}\, \mu(a)$, and using generating functions.

For the Cap-Arm coagulation equation, we formally examine when gelation occurs, and derive a PDE satisfied by the generating function.

References

[1] J. Bertoin. "Two solvable systems of coagulation equations with limited aggregations". In: *Annales de l'Institut Henri Poincaré C. Analyse Non Linéaire* 26.6 (2009), pp. 2073–2089.

[2] J. R. Norris. "Cluster Coagulation". In: *Communications in Mathematical Physics* 209.2 (2000), pp. 407–435.

Der Vortrag findet in **Raum E60, Helmholtzstr. 18** statt.
Beginn: 16 Uhr (s.t.). Alle Interessierten sind herzlich eingeladen.

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