

Prof. Dr. Abdelaziz Rhandi

Spezialvorlesung: Positivity and evolution equations

In this course we study quantitative and qualitative properties of positive semigroups on Banach lattices. Our starting point is the initial value problem (or Cauchy problem)

$$\begin{aligned}u'(t) &= Au(t), \quad t \geq 0, \\u(0) &= u_0 \in D(A),\end{aligned}$$

where A generates a positive C_0 -semigroup $(T(t))_{t \geq 0}$ on a Banach lattice E , u_0 is a given positive initial value, and the positive solution to this problem is given by $u(t) = T(t)u_0$. In the 80's, applications of positivity to Cauchy problems and specially to concrete evolution equations from transport theory, mathematical biology, and physics, has attracted much interest and was the subject of many papers. Most results of what is known about this subject can be found in the manuscript [1]. This led to remarkable progress during the last decade.

1. We start with a crash-course on operator semigroups and positive operators on Banach lattices. After that, generation theorems, spectral and perturbation theory for positive semigroups are treated in details.
2. Part II is dedicated to the study of stability of positive C_0 -semigroups and the Perron-Frobenius theory.
3. In Part III we give several applications which include positive delay equations, Koopman and Perron-Frobenius semigroups, linear Boltzmann equations, flows on networks, and age structured population equations.

The content of this course is taken mostly from the manuscript [1].

Literatur

- [1] A. Bátkai, Marjeta Kramar Fijavz and A. Rhandi: Positive Operator Semigroup: From Finite to Infinite Dimensions, Operator Theory: advances and Applications, Volume 257, Birkhäuser 2017.