LECTURE ON STRONGLY CONTINUOUS SEMIGROUPS AND HYPERBOLIC EVOLUTION EQUATIONS

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ABSTRACT. Important questions in the study of PDEs are those for existence, uniqueness and qualitative behaviour of solutions. In this lecture the focus is on time-dependent PDEs and the theory of semigroups as a tool to obtain answers for these questions. The main idea of semigroup theory in this context is to interpret a given PDE as an abstract ODE in an infinite dimensional Banach space. We will see that solutions of linear evolution equations are constructed by a semigroup which may be seen as a generalisation of the matrix exponential for unbounded operators on Banach spaces.

The aim of this lecture is to give an insight into parts of the basic theory of semigroups and how this theory may be used to solve abstract evolution equations. We first introduce some fundamental results on strongly continuous semigroups and their infinitesimal generators. Then second part is devoted to linear and semilinear hyperbolic Cauchy problems (PDEs) and how to study existence, uniqueness and qualitative behaviour of solutions by means of strongly continuous semigroups.

PREREQUISITES. Basic notions of functional analysis and PDEs should be known.

ORGANISATION.

- The lecture will be held online.
- We will have oral exams.

If you have any question concerning the course, please do not hesitate to contact me via e-mail.

LITERATURE.

- A. Pazy. Semigroups of Linear Operators and Applications to Partial Differential Equations, Springer-Verlag New York, 1983.
- K.-J. Engel & R. Nagel. One-parameter Semigroups for Linear Evolution Equations, Springer-Verlag New York, 2000.
- K.-J. Engel & R. Nagel. A Short Course on Operator Semigroups, Springer-Verlag New York, 2006.

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