

N-Cities-Seminar

Freiberg

16/12/2022

Place

SPQ-0302 (Schlossplatzquartier, Prüferstraße 4) or
<https://bbb.hrz.tu-freiberg.de/b/and-hos-zgl-fee>

Schedule

Each talk is planned to take 30 minutes plus 5 minutes discussions.

- 13:00** Christian Seifert (TU Hamburg-Harburg)
Some Results on Control Systems in Banach spaces
- 13:35** Sahiba Ahora (TU Dresden)
A tour of eventual positivity
- 14:10** Raj Dahya (U Leipzig)
Approximations and dilations of commuting families of C_0 -semigroups
- 14:45** *Coffee break*
- 15:30** Shayan Alikhanloo (TU Chemnitz)
Self-adjoint Laplacians and symmetric diffusions on hyperbolic attractors
- 16:05** Mathias Schäffner (U Halle)
Regularity for non-uniformly elliptic equations
- 16:40** Lukas Koch (MPI Leipzig)
Non-occurrence of global Laurentiev for vectorial functionals with (p, q) -growth
- 17:30** *Dinner*
“Schwanenschlößchen zu Freiberg” at Meißner Ring 33, 09599 Freiberg

Abstracts

Christian Seifert – Some Results on Control Systems in Banach spaces

For given Banach spaces X, U consider abstract control systems of the form $\dot{x}(t) = -Ax(t) + Bu(t)$ for $t \in (0, T]$ with $x(0) = x_0 \in X$, where $-A$ is the generator of a strongly continuous semigroup on X and $B: U \rightarrow X$ is a bounded linear operator. For such systems the question of null-controllability arises, i.e. whether for all initial conditions $x_0 \in X$ there exists a control function $u: [0, T] \rightarrow U$ such that $x(T) = 0$.

In this talk we will first review the classical duality result stating that this controllability question can be answered by showing a so-called final-state observability estimate of the form $\|x'(T)\| \leq C_{\text{obs}}\|y\|$, where $y: [0, T] \rightarrow Y := U'$ is the observation function of the dual system given by $x'(t) = -A'x'(t)$ for $t \in (0, T]$ with $x'(0) = x'_0 \in X'$, and $y(t) = B'x'(t)$ for $t \in (0, T]$. We then show sufficient conditions for obtaining such a final-state observability estimate, with explicit dependence of C_{obs} on all parameters. We will also comment on further generalisations, e.g. non-autonomous equations, weak versions of observability and controllability, as well as stabilizability.

The talk is based on joint works together with Clemens Bombach, Michela Egidi, Fabian Gabel, Dennis Gallaun and Martin Tautenhahn.

Sahiba Ahora – A tour of eventual positivity

Positive semigroups are today a classical topic in the theory of C_0 -semigroups. During the last few years, a theory of the weaker concept of eventually positive semigroups emerged. This theory helps in analysing linear evolution equations on function spaces whose solution for positive initial values first changes sign, but then becomes (and stays) positive.

We give an overview of the theory, focusing more on spectral results and the even weaker notion of *local* eventual positivity.

Raj Dahya – Approximations and dilations of commuting families of C_0 -semigroups

Recent research into the topological properties of spaces of C_0 -semigroups (cf. [2]) appears to crucially rely on the ability to approximate commuting families of contractive C_0 -semigroups via commuting families of unitary C_0 -semigroups. In our research, we first weakly reduce this problem to the existence of unitary dilations of commuting families of C_0 -semigroups with bounded generators. In a current preprint [1], we provide a full classification for the slightly stronger notion of regular unitary dilations in terms of a property referred to as complete dissipativity. This is a naturally definable combinatorial property expressed purely in terms of the bounded generators. I shall present this classification as well as counter-examples and an outlook.

References

- [1] R. Dahya. Dilations of commuting C_0 -semigroups with bounded generators and the von Neumann polynomial inequality. Preprint, see <https://arxiv.org/abs/2210.02353>, 2022.
- [2] R. Dahya. The space of contractive C_0 -semigroups is a Baire space. *J. Math. Anal. Appl.*, 508(1):Paper No. 125881, 12, 2022.

Shayan Alikhanloo – Self-adjoint Laplacians and symmetric diffusions on hyperbolic attractors

Analysis on smooth manifolds, foliated spaces and fractals in terms of Dirichlet forms is well established. But such an analysis on hyperbolic attractors is yet to be explored. We use the core material and central results from the theory of hyperbolic dynamical systems such as the stable manifold theorem and physical measures to introduce self-adjoint Laplacians, symmetric Markov semigroups and symmetric diffusions via Dirichlet forms. In particular, this may be seen as far-reaching extension of well-known classical analysis on geodesic flows on manifolds of negative sectional curvature.

This talk is based on joint work with Michael Hinz (Bielefeld University).

Mathias Schäffner – Regularity for non-uniformly elliptic equations

I will discuss regularity properties for solutions of linear second order non-uniformly elliptic equations in divergence form. Assuming certain integrability conditions on the coefficient field, we obtain local boundedness and validity of Harnack inequality. The assumed integrability assumptions are essentially sharp and improve upon some classical results by N. Trudinger from the 1970s. If time permit I will discuss applications on the regularity for nonlinear non-uniformly elliptic equations and homogenization theory.

Lukas Koch – Non-occurrence of global Lavrentiev for vectorial functionals with (p, q) -growth

I will give an introduction to the Lavrentiev phenomenon and present recent results demonstrating it does not occur up to the boundary for functionals with (p, q) -growth under certain restrictions on (p, q) . The exact form of the restrictions depends on the precise growth assumptions, but is related to available regularity results for minimisers of such functionals.