Summer Semester 2024 S4B2 - Graduate Seminar on PDE

Dissipative boundary value problems for wave equations

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Wednesdays 12:00 - 14:00, room: 0.006 (Endenicher Allee 60).

eCampus web-page: https://ecampus.uni-bonn.de/goto_ecampus_crs_3287002.html

Literature

[B] Borthwick, D., Spectral theory: Basic concepts and applications. Springer Nature, 2020 (fulltext available via the library).

[CZ94] Cox, S. and Zuazua, E., 1994. The rate at which energy decays in a damped string. Communications in Partial Differential Equations 19(1-2), pp.213-243; https://doi.org/10.1080/03605309408821015

[CZ95] Cox, S. and Zuazua, E., 1995. The rate at which energy decays in a string damped at one end. Indiana University Mathematics Journal, pp.545-573; http://www.jstor.org/stable/24898611.

[DZ] Dyatlov, S. and Zworski, M., Mathematical theory of scattering resonances. AMS, 2019 (see also https://math.mit.edu/ dyatlov/res/res_final.pdf).

[GG] Gorbachuk, V.I. and Gorbachuk, M.L., Boundary Value Problems for Operator Differential Equations, Springer Science & Business Media, 1991 (book available in the Präsenzbestand library, please, contact organizers to take it for longer than 1 day).

[K] Kato, T., Perturbation theory for linear operators. Springer-Verlag, 1976 (many copies available in the library).

[KZ15] Kurula, M. and Zwart, H., 2015. Linear wave systems on n-D spatial domains. International Journal of Control, 88(5), pp.1063-1077 (see also arXiv preprint https://doi.org/10.48550/arXiv.1405.1840).

[L] Leis, R., Initial Boundary Value Problems in Mathematical Physics. Tubner, 1986 (two copies avalable in the main library, for 1 more copy, please, contact organizers).

[P59] Phillips, R.S., 1959. Dissipative operators and hyperbolic systems of partial differential equations. Transactions of the American Mathematical Society, 90(2), pp.193-254; https://www.ams.org/journals/tran/1959-090-02/

[RS1] Reed, M. and Simon, B., Methods of modern mathematical physics I: Functional analysis. Academic press. 1972 (many copies available in the library).

[RS4] Reed, M. and Simon, B., Methods of modern mathematical physics IV: Analysis of operators. Academic press. 1978 (many copies available in the library).

List of Topics.

No.	Title of the topic and short description
1	**Graphs of operators, closed, adjoint, symmetric, selfadjoint, unitary, accretive, and dissipative operators. Examples for PDEs.** Introduction and reminder for basic notions and PDEs examples [L, Section 2.2], [B, Sections 3.1-3.3], [B, p.47-48 of Section 3.4] and [B, Sections 3.4.1, 3.4.2].
2	**Resolvent and spectrum. Isolated eigenvalues and the discrete spectrum.** [B, Definition 4.1, Sections 4.1.1, 4.1.2, 4.2.2] and [RS4, Theorem XII.5 and the definition after this theorem], possibly also [K, Theorem III.6.29].

3	**Friedrichs extension of semibounded symmetric operators. Laplacians in domains.** [B, Section 3.4.3] (see also [L, Theorem 2.9 (7)]), [L, Section 2.3] (see also [B, Section 6.1]), possibly also [B, Section 4.1.3].
4	**Spectral theorem for selfadjoint operators via spectral projection measure. Various types of spectra.** The part of [L, Section 2.2] starting from Definition 2.12, and [RS1, Section VII.3].
5	**Functional calculus for selfadjoint operators. Stone's theorem on strongly continuous 1-parameter unitary groups.** [RS1, Theorems VIII.5 and VIII.6] and [RS1, Section VIII.4].
6	**The evolution equation of linear acoustics.** [L, Sections 7.1, 7.2, and 7.4]
7	**Contraction semigroups and their connection with m-accretive and maximal dissipative operators.** [L, Theorem 2.15] (see also [K, Sections IX.1-IX.3]), [K, Section V.3.10], and [P59, from Theorem 1.1.1 to Theorem 1.1.3].
8	**Boundary triples and the description of dissipative extensions of symmetric operators.** [GG, Section 3.1.4] (possibly also some preparational definitions and results from [GG, Sections 3.1.1, 3.1.2]) and [KZ15, Theorem 3.2], possibly also [GG, Theorem 3.3.1].
9	**The equation of internally damped string.** Main settings and results of [CZ94].
10	**The equation of a string with boundary damping. Resonances.** Main settings and results of [CZ95] and [DZ, Sections 2.1-2.3].