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Optimal rates of decay for semigroups on Hilbert spaces

We discuss the quantitative asymptotic behaviour of operator semigroups. In [2] Batty and Duyckaerts obtained upper and lower bounds on the rate of decay of a semigroup given bounds on the resolvent growth of the semigroup generator. They conjectured that in the Hilbert space setting and for the special case of polynomial resolvent growth it is possible to improve the upper bound so as to yield the exact rate of decay up to constants. This conjecture was proved to be correct by Borichev and Tomilov in [3], and the conclusion was extended by Batty, Chill and Tomilov in [1] to certain cases in which the resolvent growth is not exactly polynomial but almost. In this talk we extend their result by showing that one can improve the upper bound under a significantly milder assumption on the resolvent growth. This result is optimal in a certain sense. We also discuss how this improved result can be used to obtain sharper estimates on the rate of energy decay for a wave equation subject to viscoelastic damping at the boundary. The talk is based on joint work with J. Rozendaal and R. Stahn.

References

[1] C.J.K. Batty, R. Chill, and Y. Tomilov, *Fine scales of decay of operator semigroups*, J. Eur. Math. Soc. **18** (2016), no. 4, 853–929.

[2] C.J.K. Batty and T. Duyckaerts, *Non-uniform stability for bounded semigroups on banach spaces*, J. Evol. Equ. **8** (2008), no. 4, 765–780.

[3] A. Borichev and Y. Tomilov, *Optimal polynomial decay of functions and operator semigroups*, Math. Ann. **347** (2010), no. 2, 455–478.