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Stability results of dissipative systems via the frequency domain approach

The frequency domain approach goes back to J. Prüss [Trans. Amer. Math. Soc. 284 (1984), 847-857] and F. L. Huang [Ann. Differential Equations 1 (1985), 43-56] that show that a C_0 semigroup $(e^{tA})_{t\geq 0}$ of contractions in a Hilbert space H is exponentially stable if and only if the resolvent of A is uniformly bounded on the imaginary axis. Afterwards Z. Liu and B. Rao, [Z. Angew. Math. Phys. 56 (2005), 630-644], C. J. K. Batty and T. Duyckaerts [J. Evol. Equ. 8 (2008), 765-780], and A. Bátkai, K.-J. Engel, J. Prüss and R. Schnaubelt [Math. Nachr. 279 (2006), 1425-1440] have given some sufficient conditions on the behavior of the resolvent of A on the imaginary axis that guarantee an almost polynomial decay of the semigroup. Finally an optimal result about the polynomial decay was found by A. A. Borichev and Yu. V. Tomilov [Math. Ann. 347 (2010), 455-478]. This approach is a powerful tool for the study of the decay of the semigroup associated with concrete dissipative systems since it reduces to the study of the resolvent on the imaginary axis. In our talk, we will first recall these two results and then illustrate them on two particular dissipative systems, namely a generalized telegraph equation [Z. Angew. Math. Phys. 66 (2015), 3221-3247] and a dispersive medium model (joint work with C. Scheid (Univ. Nice)).