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Boundary value problems with dynamic boundary conditions

In this talk, we consider boundary value problems with dynamic boundary conditions under various aspects. The problems we consider have the form

$$
\begin{aligned}
\partial_t u - A u &= f && \text{in} && (0, \infty) \times G, \\
\partial_t u - B_1 u &= g_1 && \text{on} && (0, \infty) \times \partial G, \\
B_j u &= g_j \quad (j = 2, \ldots, m) && \text{on} && (0, \infty) \times \partial G
\end{aligned}
$$

(with appropriate initial conditions) in a sufficiently smooth domain $G \subset \mathbb{R}^n$, where A is a partial differential operator of order $2m$ and B_j are boundary operators of order $m_j < 2m$. We investigate the corresponding operator which acts on the space $L^p(G) \times L^p(\partial G)$. In the talk, we restrict ourselves to some prototype examples of order $2m = 2$ and $2m = 4$.

In simple situations, where the operator is of second order and can be defined by form methods, one can show the existence of a bounded H^∞-calculus for all $p \in (1, \infty)$. In more complicated situations, we discuss the generation of a holomorphic C_0-semigroup, maximal L^p-regularity and the description of the domain of the operator. For this, we also use results on a specific kind of anisotropic Sobolev spaces.

This talk is based on joint works with Simon Bau (Konstanz), David Ploß (Karlsruhe), Sophia Rau (Konstanz), and Jörg Seiler (Torino).