Some boundary value problems for operator-differential equations of mixed type and their applications to inverse problems

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First we consider the questions on existence and uniqueness of a solution to the boundary value problem

$$B(t)u_t = L(t)u + f(t), \ t \in (0, T), \ T < \infty,$$

$$u(T) - u(0) = u_0.$$

Here $B(t)$ are self-adjoint operators and $L(t)$ are uniformly dissipative operators acting in a complex Hilbert space E with the inner product $(\cdot, \cdot)$ and the norm $\| \cdot \|$. The operator $B(t)$ can be noninvertible and has arbitrary arrangement of the spectrum.

Then we apply obtained results to the following linear inverse problem: to find a function $u(t)$ and an element φ satisfying the equation

$$B(t)u_t = Lu + f(t) + B(0)\varphi$$

and the boundary conditions

$$u(0) = u_0, \ u(T) = u_1.$$