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Inverse Potential Problems for Anomalous Diffusion Processes

Abstract. In this talk, we address an inverse problem associated with a time-fractional diffusion equation of order $0 < \alpha < 1$, which models anomalous diffusion processes. The goal is to identify an unknown potential q^* in the equation:

$$\partial_t^\alpha u - \Delta u + q^* u = 0,$$

from additional Dirichlet boundary data. This problem is motivated by several applications in physics and engineering where memory effects or nonlocal dynamics are present. We establish a local stability estimate for the reconstruction of q^*, under suitable assumptions on the regularity and positivity of the data. To solve the inverse problem, we reformulate it as a **functional optimization problem**. We employ a self-regularizing Kohn–Vogelius-type formulation, which is well suited for ill-posed inverse problems. This approach provides accurate and robust reconstructions of the potential, even in the presence of noise on the boundary measurements.