

Controllability Problem of a Differential Equation with Memory

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Abstract

In this talk we address control problems governed by a semilinear evolution equation with memory kernel $\kappa \in L^1_{loc}(\mathbb{R}^+)$. We examine the existence of a mild solution and the approximate controllability of both linear and semilinear control systems. To this end, we introduce the concept of a resolvent family associated with the linear evolution equation with memory and develop some of its essential properties. Subsequently, we consider a linear-quadratic regulator problem to determine the optimal control that yields approximate controllability for the linear control system. Furthermore, we derive sufficient conditions for the existence of a mild solution and the approximate controllability of a semilinear system in a reflexive Banach space having uniformly convex dual. Additionally, we present an approximate controllability result within the framework of a general Banach space. Finally, we apply our theoretical findings to investigate the approximate controllability of the heat equation with singular memory.

Recently, Pandolfi [1] studied the approximate controllability of a general class of control systems with singular memory by applying boundary control. The considered system particularly includes systems with fractional derivatives and integrals as well as the standard heat equation.

References

- [1] Pandolfi, L.: Controllability properties for equations with memory of fractional type, *Appl. Math. Optim.*, **84**(1) (2021) 325–353.