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## A Schrödinger Equation with Internal Fractional Damping : Existence, Uniqueness and Stability.

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## Abstract

This study focuses on the stability analysis of a linear Schrödinger equation defined on an n-dimensional open bounded domain with Dirichlet boundary conditions, incorporating a fractional-order damping term acting internally. We first transform the governing system into an augmented framework and demonstrate its well-posedness through semigroup theory. Utilizing the Arendt-Batty criterion (a sufficient condition for strong stability in operator semigroups), we rigorously establish the strong stability of the system. Furthermore, by integrating frequency-domain analysis with multiplier-based methodologies, we derive a sharp polynomial decay rate for the system's energy, confirming its optimality.

Key words and phrases: Schrödinger equation, Internal fractional damping, Optimal polynomial decay rate.

AMS (MOS) Subject Classifications: 93D15, 35B40, 47D03, 74D05.

## References

- W. Arendt and C. J. K. Batty, *Tauberian theorems and stability of one-parameter semi*groups, Trans. Am. Math. Soc., **306** (1988), 837-852.
- [2] A. Borichev, Y. Tomilov, Optimal polynomial decay of functions and operator semigroups, Math. Ann. 347 (2010)-2, 455-478.
- M. M. Cavalcanti, V. N. Domingos Cavalcanti, A. Guesmia, and M. Sepulveda, Wellposedness and stability for Schrödinger equations with infinite memory, Appl. Math. Optim. 85 (2022)-2, Paper No. 20, 31 pp.

- [4] J. U. Choi, R. C. Maccamy, Fractional order Volterra equations with applications to elasticity, J.Math. Anal. Appl., 139 (1989), 448-464.
- [5] E. Machtyngier, E. Zuazua, Stabilization of the Schrödinger equation, Portugal. Math. 51 (1994)-2, 243-256.
- [6] I. Meradjah, N. Louhibi, A. Benaissa, Stability of a Schrödinger Equation with Internal Fractional Damping, Annals of the University of Craiova, 50(2) (2023), 427-441.