

# ICRAMCS 2026

THE EIGHTHEDITION OF THE INTERNATIONAL CONFERENCE ON  
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE  
April 23-24-25, 2026 | Marrakech, Morocco



## On a Fractional Cauchy Problem with Singular Initial Data

### Communication Info

#### Authors:

Abdelmjid Benmerrous<sup>1,2</sup>  
M'hamed Elomari<sup>1</sup>

<sup>1</sup>Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, PO Box 532, Beni Mellal, 23000, Morocco.

<sup>2</sup>Departement of Mathematics, Regional Centre for the Professions of Education and Training, Beni Mellal-Khenifra, Khenifra Branch, Morocco.

#### Keywords:

- (1) Colombeau algebra
- (2) Cauchy problem
- (3) Caputo derivative
- (4) Banach space

### Abstract

This paper is dedicated to establishing the existence and uniqueness of solutions for the following problem

$$D^\alpha x(t) = F(t, x(t))$$
$$x(0) = x_0$$

where  $x_0$  is singular generalized functions and  $F$  satisfies  $L^\infty$  logarithmic type,  $D^\alpha$  is Caputo derivative of order  $m-1 < \alpha < m$  with  $m \in \mathbb{N}^*$  which we will confirm to be present in Colombeau algebra. The Gronwall lemma is used in Colombeau's algebra to establish the main results. To illustrate our theoretical analysis, we ended our work with an example.

© ICRAMCS 2026 Proceedings ISSN: 2605-7700

### References

- [1] Benmerrous, A., Chadli, L. S., Moujahid, A., M'hamed, E., & Melliani, S. Generalized solution of Schrödinger equation with singular potential and initial data. *International Journal of Nonlinear Analysis and Applications*, 13(1), (2022) 3093-3101.
- [2] Benmerrous, A., Chadli, L.s., Moujahid, A. et al. Generalized Cosine Family. *J Elliptic Parabol Equ* (2022). <https://doi.org/10.1007/s41808-022-00156-x>.
- [3] Benmerrous, A., Chadli, L. S., Moujahid, A., Elomari, M. H., & Melliani, S. Colombeau products of distributions. *International Journal On Optimization and Applications*, (2022) 11.
- [4] Benmerrous, A., Chadli, L. S., Moujahid, A., Elomari, M. H., & Melliani, S. Solution of Schrödinger type Problem in Extended Colombeau Algebras. In *2022 8th International Conference on Optimization and Applications (ICOA)* (2022, October). (pp. 1-5). IEEE.
- [5] Colombeau, J.F. and Heibig, A.: Generalized solutions to Cauchy problems *Monatshefte fur Mathematik*, 117, (1994) 33-49.