

GLOBAL SOLUTIONS OF ANOMALOUS DIFFUSION SYSTEMS 3×3

ABDELATIF TOUALBIA AND NABILA BARROUK*

Abstract. In this article, we establish a global existence result for a nonlinear reaction-diffusion system in the case of 3 components with fractional Laplacians. Our proof method is based on the well-known regularizing effect.

Mathematics subject classification (2020): 35K57, 37L05, 35A01, 35R11.

Keywords and phrases: Local solution, global solution, fractional reaction-diffusion systems, matrice of diffusion.

REFERENCES

- [1] A. ALSAEDI, M. AL-YAMI, M. KIRANE, F. MOMENKHAN, *A triangular nonlinear reaction-fractional diffusion system with a balance law*, Math. Meth. Appl. Sci. 2017; 1–6.
- [2] N. BARROUK AND S. MESBAHI, *Existence of global solutions of a reaction-diffusion system with a cross-diffusion matrix and fractional derivatives*, Palest. J. Math. **13** (3) (2024) 340–353.
- [3] I. M. BATIHA, N. BARROUK, A. OUANNAS, W. G. ALSHANTI, *On Global existence of the fractional reaction-diffusion system's solution*, Int. J. Anal. Appl. (2023), 21:11.
- [4] M. BONFORTE, A. FIGALLI, X. ROS-OTON, *Infinite speed of propagation and regularity of solutions to the fractional porous medium equation in general domains*, Commun. Pure Appl. Math. **70** (8) (2017), 1472–1508.
- [5] H. BREZIS, *Functional analysis, sobolev spaces and partial differential equations*, Springer, New York, NY, 2010.
- [6] M. DAOUD, E. H. LAAMRI, *Fractional laplacians: A short survey*, Discrete Contin. Dyn. Syst. S **15** (1) (2022), 95–116.
- [7] M. DAOUD, E. H. LAAMRI, A. BAALAL, *A class of fractional parabolic reaction-diffusion systems with control of total mass: theory and numerics*, 2023, hal-04123268.
- [8] E. DI NEZZA, G. PALATUCCI, E. VALDINOI, *Hitchhiker's guide to the fractional Sobolev spaces*, Bull. Sci. Math. **136** (5) (2012), 521–573.
- [9] N. GAROFALO, *Fractional thoughts*, arXiv preprint arXiv:1712.03347, (2017).
- [10] D. HENRY, *Geometric Theory of semi-linear parabolic equations*, Lecture Notes in Mathematics 840, Springer-Verlag, New-York, 1984.
- [11] D. HNAIEN, F. KELLIL, R. LASSOUED, *Asymptotic behavior of global solutions of an anomalous diffusion system*, J. Math. Anal. Appl. **421** (2015), 1519–1530.
- [12] M. ILIC, F. LIU, I. TURNER, V. AHN, *Numerical approximation of a fractional-in-space diffusion equation (II) – with nonhomogeneous boundary conditions*, Fract. calc. Appl. Anal. **9** (2006), 333–349.
- [13] G. KARCH, *Nonlinear evolution equations with anomalous diffusion*, in: Jindřich Nečas Cent. Math. Model. Lect. Notes, vol. 5 matfyzpress, Prague 2009, pp. 25–68.
- [14] S. KOUACHI, *Existence of global solutions to reaction-diffusion systems with non homogeneous boundary conditions via a Lyapunov functional*, Elec. Jour. Differ. Equat, vol. 2002 (2002), no. 88, pp. 1–13.
- [15] F. A. OLIVEIRA, M. S. FERREIRA, L. C. LAPAS, M. H. VAINSTEIN, *Anomalous diffusion: A Basic mechanism for the evolution of inhomogeneous systems*, Frontiers in physics, vol. 7, 2019.
- [16] J. SMOLLER, *Shock waves and reaction-diffusion equations*, Springer Verlag, New York (1983).
- [17] M. YAMAMOTO, *Asymptotic expansion of solutions to the dissipative equation with anomalous diffusion*, SIAM J. Math. Anal. **44** (6), 2012.