

ICRAMCS 2026

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



Existence and multiplicity of solutions for a fractional elliptic system with strongly coupled critical terms

Communication Info

Authors:

Khalid BOUABID¹
Rachid ECHARGHAOUI¹

¹ Department of Mathematics, Faculty of Sciences, Ibn Tofail University, Kenitra, B. P. 133, Morocco.

Keywords:

- (1) Fractional Laplacian system
- (2) strongly coupled critical terms
- (3) multiplicity
- (4) concave-convex nonlinearities
- (5) Lusternik–Schnirelmann category

Abstract

In this paper, we study the existence and multiplicity results of positive solutions for the following fractional elliptic system with strongly coupled critical terms and concave nonlinearities.

$$\begin{cases} (-\Delta)^s u = \frac{\eta_1 \alpha_1}{2_s^*} |u|^{\alpha_1-2} |v|^{\beta_1} u + \frac{\eta_2 \alpha_2}{2_s^*} |u|^{\alpha_2-2} |v|^{\beta_2} u + \lambda \frac{|u|^{q-2} u}{|x|^\gamma}, & x \in \Omega, \\ (-\Delta)^s v = \frac{\eta_1 \beta_1}{2_s^*} |u|^{\alpha_1} |v|^{\beta_1-2} v + \frac{\eta_2 \beta_2}{2_s^*} |u|^{\alpha_2} |v|^{\beta_2-2} v + \mu \frac{|v|^{q-2} v}{|x|^\gamma}, & x \in \Omega, \\ u = v = 0, & \text{on } \partial\Omega, \end{cases}$$

where $\eta_1, \eta_2, \lambda, \mu$, are positive, $2_s^* := \frac{2N}{N-2s}$ is the fractional Sobolev critical exponent, $N > 2s$, $\alpha_1 + \beta_1 = 2_s^*$, $\alpha_2 + \beta_2 = 2_s^*$, and $(-\Delta)^s$ is the spectral fractional Laplacian. With the help of the Nehari manifold and the Ljusternik-Schnirelmann category, we prove that the problem admits at least $\text{cat}(\Omega) + 1$ distinct positive solutions.

© ICRAMCS 2026 Proceedings ISSN: 2605-7700

References

- [1] Alves, C.O. De Morais Filho, D.C. Souto, M.A.S.: On systems of elliptic equations involving subcritical or critical Sobolev exponents, *Nonlinear Anal.* 42, 771–787 (2000).
- [2] Alves, C.O. Ding, Y.H.: Multiplicity of positive solutions for the p-Laplacian equation involving critical nonlinearity, *J. Math. Anal. Appl.* 279, 508–521 (2003).
- [3] Barrios, B. Colorado, E. De Pablo, A. Sánchez, U.: On some critical problems for the fractional Laplacian, *J. Differential Equations* 252, 6133–6162. (2012).
- [4] Benhachmi, K. Echarghaoui, R. Hatimi, A. Hadad, H.: Multiplicity of Positive Solutions for a Fractional Elliptic System With Strongly Coupled Critical Terms, *Int. J. Anal. Appl.*, 22 (2024).
- [5] Benmouloud, S. Echarghaoui R. Sbaï, S. M.: Multiplicity of positive solutions for a critical quasilinear elliptic system with concave and convex nonlinearities. *Journal of Mathematical Analysis and Applications*,