

# ICRAMCS 2026

THE EIGHTH EDITION OF THE INTERNATIONAL CONFERENCE ON  
RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

April 23-24-25, 2026 | Marrakech, Morocco



## Stackelberg-Nash controllability for stochastic parabolic equations

### Communication Info

#### Authors:

Omar Oukdach<sup>1</sup>

Said Boulite<sup>2</sup>

Abdellatif Elgrou<sup>3</sup>

Lahcen Maniar<sup>3</sup>

Moulay Ismaïl University of  
Meknes, FST Errachidia, MSISI  
Laboratory, Errachidia, Morocco  
<sup>1</sup>

Cadi Ayyad University, National  
School of Applied Sciences,  
LM DP, Marrakech, Morocco<sup>2</sup>

Cadi Ayyad University, Faculty  
of Sciences Semlalia, LM DP,  
Marrakech, Morocco<sup>3</sup>

#### Keywords:

(1) Null controllability

(2) Stackelberg-Nash  
strategies

(3) Stochastic equations

### Abstract

We study a hierarchical control problem for stochastic parabolic equations involving gradient terms. We employ the Stackelberg-Nash strategy with two leaders and two followers. The leaders are responsible for selecting the policy targeting null controllability, while the followers solve a bi-objective optimal control problem which consists of maintaining the solution process close to prefixed targets. Once the Nash equilibrium is determined, the problem reduces to achieving null controllability of a coupled forward-backward stochastic system. To solve this problem, via Carleman estimates, we establish a suitable observability in-equality. Subsequently, we achieve the desired controllability result.

© ICRAMCS 2026 Proceedings ISSN: 2605-7700

### References

[1] O. Oukdach, I. Boutaayamou and L. Maniar, Hierarchical control problem for the heat equation with dynamic boundary conditions, IMA Journal of Mathematical Control and Information, 41 (2024), 255–274.

[2] F. D. Araruna, E. Fernandez-Cara and M. C. Santos, Stackelberg-Nash exact controllability for linear and semilinear parabolic equations, ESAIM: Control, Optimisation and Calculus of Variations, 21 (2015), 835–856.