Topological Methods in Nonlinear Analysis
DOI: 10.12775/TMNA.2024.017

TOPOLOGICAL DEGREE FOR SOME PARABOLIC EQUATIONS WITH RIEMANN–LIOUVILLE TIME-FRACTIONAL DERIVATIVES

Abderrahim Charkaoui — Anouar Ben-loghfyry

Abstract. This work tackles a class of nonlinear parabolic equations in divergence form having fractional time order derivatives. We consider parabolic equations involving second-order spacial operators with Riemann–Liouville time-fractional derivatives. We establish the existence and uniqueness of weak solutions to the studied models. Our theoretical approach relies essentially on the use of Leray–Schauder topological degree and involves some new technical estimates.

1. Introduction

Recently, a growing number of works through many authors from various research fields of science and engineering deal with Partial Differential Equations (PDEs) described by a fractional-order equations. These fractional PDEs cover a numerous fields, such as chemistry [22], [44], viscoelasticity [31], [32], plasma physics [1], [38], mechanics of materials [11], [14], fluid mechanics [25], [34], biology [9], [19], finance [39], [42], image processing [5]–[7], [45].

2020 *Mathematics Subject Classification.* Primary: 47J35, 35K55; Secondary: 35B10, 35D30, 35A16.

Key words and phrases. time-fractional derivatives; Riemann–Liouville; weak solutions; topological degree; Faedo–Galerkin method; fractional problems.

Please cite this article as: Abderrahim Charkaoui, Anouar Ben-loghfyry, *Topological degree for some parabolic equations with Riemann–Liouville time-fractional derivatives*, Topol. Methods Nonlinear Anal. (2024).
DOI: 10.12775/TMNA.2024.017