

Accepted Manuscript

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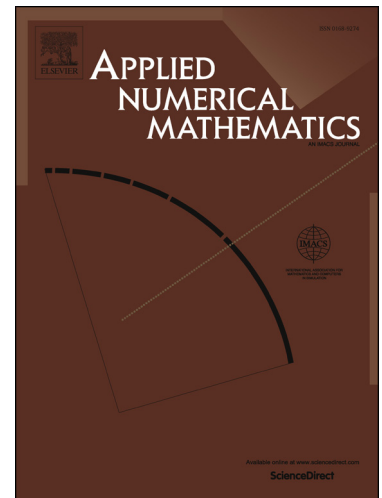
PII: S0168-9274(18)30016-3
DOI: <https://doi.org/10.1016/j.apnum.2018.01.007>
Reference: APNUM 3310

To appear in: *Applied Numerical Mathematics*

Received date: 13 May 2016
Revised date: 17 November 2017
Accepted date: 9 January 2018

Please cite this article in press as: R.M.P. Almeida et al., Finite element schemes for a class of nonlocal parabolic systems with moving boundaries, *Appl. Numer. Math.* (2018), <https://doi.org/10.1016/j.apnum.2018.01.007>

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Finite element schemes for a class of nonlocal parabolic systems with moving boundaries

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Abstract

The aim of this paper is to study the convergence, properties and error bounds of the discrete solutions of a class of nonlinear systems of reaction-diffusion nonlocal type with moving boundaries, using the finite element method with polynomial approximations of any degree and some classical time integrators. A coordinate transformation which fixes the boundaries is used. Some numerical tests to compare our Matlab code with a moving finite element method are investigated.

Keywords: nonlinear parabolic system, nonlocal diffusion term, reaction-diffusion, convergence, numerical simulation, Euler, Crank-Nicolson, finite element method.

1. Introduction

In this work, we study nonlinear nonlocal parabolic systems of the following type:

$$\begin{cases} \frac{\partial u_i}{\partial t} - a_i \left(\int_{\Omega_t} u_1(x, t) dx, \dots, \int_{\Omega_t} u_{n_e}(x, t) dx \right) \frac{\partial^2 u_i}{\partial x^2} = f_i(x, t), & (x, t) \in Q_t \\ u_i(\alpha(t), t) = u_i(\beta(t), t) = 0, & t > 0 \\ u_i(x, 0) = u_{i0}(x), & x \in \Omega_0 =]\alpha(0), \beta(0)[, \quad i = 1, \dots, n_e \end{cases} \quad (1)$$

where Q_t is a bounded non-cylindrical domain defined by

$$Q_t = \{(x, t) \in \mathbb{R}^2 : \alpha(t) < x < \beta(t), 0 < t < T\} \quad (2)$$

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