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NUMERICAL SIMULATIONS OF THE DEGN-HARRISO MODEL IN THE NORMAL PARTIAL DISCRETE STATE: CASE $0 < \alpha < 1$

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Abstract. The goal of this study is to develop a numerical studies for the discrete fractional Lengyel-Epstein reaction-diffusion system as a examples of the chlorite-iodide-malonic-acid chemical reaction abbreviated as (CIMA) and Degn-Harriso model. Among the systems they represent is a model of pollutant migration in natural dispersed media where the aim of their studies are to determine the behavior of contaminants in heterogeneous porous media. To obtain stability analysis, the second-order centered difference approximation of the second derivative Δu was applied, Euler's first order Taylor series method were taken into account. Besides, a numerical study testify the computational efficiency of the algorithms to the proposed model and present numerical results to verify the established analysis.

Keywords. Discrete fractional, Reaction-diffusion, Finite difference method, Degn-Harriso model, Stability, Simulation.

AMS (MOS) subject classification: 65N06, 65N12, 65T50, 35R11.

1 Introduction

Model descriptions of many phenomena of a diffusion nature, representing spatial and temporal changes in the concentration of a substance, or accompanying processes of heat and charge transfer, for a number of amorphous structures, porous media, liquid crystals, polymers, biopolymers, proteins, biosystems and even ecosystems often do not agree with real observations [1, 2]. Such processes can be accompanied by significant gradient changes in the analyzed characteristics or a very long waiting time for aftereffects. One of the approaches to constructing mathematical models of non-standard diffusion and transfer phenomena in heterogeneous, complexly structured and hereditary systems is based on the use of the analytical apparatus of fractal theory. The deterministic model of a non-stationary diffusion process is