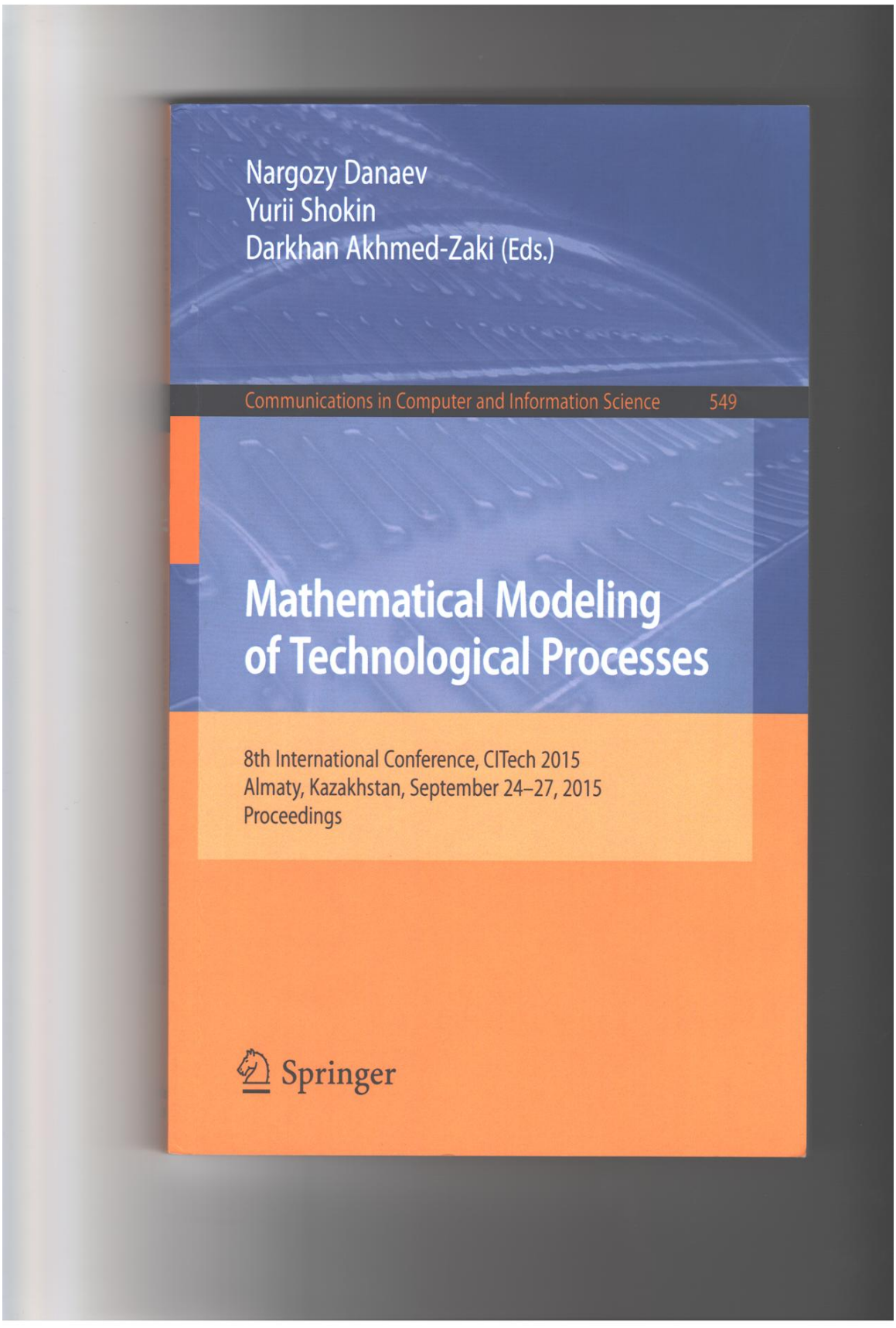
Nargozy Danaev
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Nargozy Danaev, D

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Abstract. This
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tance factor. Res
domain are pres
uration, concentr
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comparing with t
aim of this work i
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of the combined

Keywords: EOI

1 Introduction

The investigations sho
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methods. There are var
fluids, such as adsorpt
used to reduce the int
and increase the mobili
method used for enhan
and increasing viscosity
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combination with wate
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When using this metho

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heat transfer. In contrast to the
use of the phase pressure as the
unctions are eliminated from the
l temperature which lead to unre-
ns approach their residual values.
e proves the boundedness of the
coefficients in the equations. The
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hat allows the use of the proposed
r problems.

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Self-Organization Phenomena in Underground Hydrogen Storages

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Abstract. The problem of underground hydrogen gas mixture storage is that unlike natural gas, hydrogen gas mixture undergoes chemical changes in underground storage and thus the concentration of hydrogen and carbon dioxide is reduced, and the concentration of methane increases. It has been found that these changes occur because of the activity of methanogenic bacteria populations inhabiting in a reservoir. This chemical activity, which caused by the bacterial activity, as well as gas and water flow in the reservoir causes the phenomenon of self-organization such as the occurrence of autowave spatial structures, the dynamics of which is characterized by a multiplicity of different scenarios, including the occurrence of chaos and the jump from one scenario to another. In this paper we developed a qualitative theory of self-organization scenarios in the underground hydrogen storage depending on the external and internal parameters. Development of the theory and computer models of transport in underground hydrogen storage will be based on the relating of models of multiphase composite flows in porous media with model of dynamics of bacterial populations which will be based on mechanism of chemotaxis (internal chemical mechanism by which bacteria are able to detect the presence of nutrients in the distance and move in that direction).

Keywords: Porous media · Hydrogen · Reactive transport · Bacteria · Methanogenic microorganisms · Population dynamics · Oscillations · Chemotaxis

1 Introduction

Increasing energy demand and anthropogenic greenhouse-gas emissions pose serious challenges for national and international energy economies. Low emissions and the increasing efficiency of fuel cells make the case for the use of hydrogen (H_2) as the fuel of the future [1]-[2]. At best, H2 is generated, e.g. through electrolysis, from renewable energy sources. In such a scheme, storing H_2 comes down to storing electricity. However, it may also be produced from fossil fuels, making it easier to contain emissions at the power plants while distributing clean energy in form of H_2, e.g. for transportation.

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