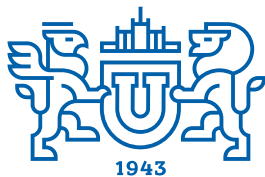


ВЕСТНИК



**ЮЖНО-УРАЛЬСКОГО
ГОСУДАРСТВЕННОГО
УНИВЕРСИТЕТА**

**2022
Т. 15, № 4**

ISSN 2071-0216 (Print)
ISSN 2308-0256 (Online)

СЕРИЯ

«МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ И ПРОГРАММИРОВАНИЕ»

Решением ВАК России включен в Перечень рецензируемых научных изданий

**Учредитель – Федеральное государственное автономное образовательное
учреждение высшего образования**

**«Южно-Уральский государственный университет
(национальный исследовательский университет)»**

Основной целью издания является пропаганда союза качественных и численных исследований математических моделей. Предпочтение при публикации будут иметь статьи, посвященные результатам качественных исследований математических моделей, выявляющих какие-либо неочевидные их свойства; результатам численных исследований, содержащих разработки новых вычислительных алгоритмов применительно к математическим моделям; и комплексам программ, созданным для постановки вычислительных экспериментов.

Редакционная коллегия

к.ф.-м.н., доц. **Бычков Е.В.**,
к.ф.-м.н., проф. **Заляпин В.И.**,
д.ф.-м.н., проф. **Замышляева А.А.**,
д.ф.-м.н., доц. **Келлер А.В.**,
д.ф.-м.н., проф. **Манакова Н.А.**
(*отв. секретарь*),
д.ф.-м.н., проф. **Свиридюк Г.А.**
(*гл. редактор*)

Редакционный совет

проф., д-р **Аббас С.**,
д.ф.-м.н., проф. **Банасяк Я.**,
д.т.н., проф. **Богомоллов А.В.**,
д.т.н., проф. **Володарский Е.Т.**,
проф., д-р **Вонг П.**,
д.ф.-м.н., проф. **Зелик С.В.**,
проф., д-р **Йонг Ли**,

д.ф.-м.н., проф. **Кадченко С.И.**,
д.ф.-м.н., акад. НАН Республики
Казахстан **Кальменов Т.Ш.**,
д.ф.-м.н., проф. **Корпусов М.О.**,
д.т.н., акад. РАН **Новиков Д.А.**
(*председатель*),
д.т.н., г.н.с. **Поляк Б.Т.**,
д.ф.-м.н., проф. **Пятков С.Г.**,
проф., д-р **Ривера Ж.Е.М.**,
проф., д-р **Та Зуй Фыонг**,
проф., д-р **Тиба Д.**,
д.т.н., проф. **Уткин Л.В.**,
проф., д-р **Фавини А.**,
д.ф.-м.н., проф. **Фурсиков А.В.**,
д.ф.-м.н., чл.-кор. РАН **Ченцов А.Г.**

© Издательский центр ЮУрГУ, 2022



BULLETIN

OF THE SOUTH URAL
STATE UNIVERSITY

2022

Vol. 15, no. 4

SERIES

“MATHEMATICAL MODELLING,
PROGRAMMING & COMPUTER
SOFTWARE”

ISSN 2071-0216 (Print)
ISSN 2308-0256 (Online)

**Vestnik Yuzhno-Ural'skogo Gosudarstvennogo Universiteta.
Seriya “Matematicheskoe Modelirovanie i Programmirovanie”**

South Ural State University

Main purpose of the publication is to promote the union of the qualitative of numerical studies of mathematical models. Articles, devoted to the results of qualitative studies of mathematical models, that identify any non-obvious properties, the results of numerical studies that contain the development of new computational algorithms applied for the computational experiments, will have the preference for publication.

Editorial Board

E.V. Bychkov, South Ural State University, Chelyabinsk, Russian Federation
A.V. Keller, Voronezh State Technical University, Voronezh, Russian Federation
N.A. Manakova, South Ural State University, Chelyabinsk, Russian Federation
G.A. Sviridyuk, South Ural State University, Chelyabinsk, Russian Federation
V.I. Zalyapin, South Ural State University, Chelyabinsk, Russian Federation
A.A. Zamyshlyayeva, South Ural State University, Chelyabinsk, Russian Federation

Editorial Council

S. Abbas, Indian Institute of Technology Mandi, Mandi, India
J. Banasiak, University of Pretoria, Pretoria, Republic of South Africa
A.V. Bogomolov, Burnasyan Federal Medical Biophysical Center of Federal Medical Biological Agency, Moscow, Russian Federation
A.G. Chentsov, Krasovskii Institute of Mathematics and Mechanics, Ural Branch of the RAS, Yekaterinburg, Russian Federation
A.V. Fursikov, Lomonosov Moscow State University, Moscow, Russian Federation
A. Favini, University of Bologna, Bologna, Italy
S.I. Kadchenko, Nosov Magnitogorsk State Technical University, Magnitogorsk, Russian Federation
T.Sh. Kal'menov, Institute of Mathematics and Mathematical Modelling, Almaty, Kazakhstan
M.O. Korpusov, Lomonosov Moscow State University, Moscow, Russian Federation
D.A. Novikov, V.A. Trapeznikov Institute of Control Sciences of the RAS, Moscow, Russian Federation
B.T. Polyak, V.A. Trapeznikov Institute of Control Sciences of the RAS, Moscow, Russian Federation
S.G. Pyatkov, Sobolev Institute of Mathematics, Siberian Branch of the RAS, Novosibirsk, Russian Federation
J.E.M. Rivera, Federal University of Rio de Janeiro, Institute of Mathematic, Rio de Janeiro, Brazil
Ta Duy Phuong, Hanoi Institute of Mathematics, Hanoi, Vietnam
D. Tiba, Institute of Mathematics Romanian Academy, Bucharest, Romania
E.T. Volodarskiy, National Technical University, Kiev, Ukraine
L.V. Utkin, Peter the Great Saint-Petersburg Polytechnic University, Saint Petersburg, Russian Federation
P.J.Y. Wong, Nanyang Technological University, School of Electrical and Electronic Engineering, Singapore, Singapore
Yong Li, College of Electrical and Information Engineering, Hunan University, Changsha, China
S.V. Zelik, University of Surrey, Guildford, United Kingdom

Содержание

Математическое моделирование

ПРИМЕНЕНИЕ ДРОБНО-РАЦИОНАЛЬНЫХ ИНТЕРПОЛЯЦИЙ ДЛЯ РЕШЕНИЯ
КРАЕВЫХ ЗАДАЧ С ОСОБЕННОСТЯМИ

Б.В. Семисалов 5

DIFFERENTIAL EQUATIONS OF ELLIPTIC TYPE WITH VARIABLE OPERATORS
AND HOMOGENEOUS ROBIN BOUNDARY VALUE CONDITION
IN UMD SPACES

Rabah Haoua 20

TWO-STAGE PARAMETRIC IDENTIFICATION PROCEDURE
FOR A SATELLITE MOTION MODEL BASED ON ADAPTIVE UNSCENTED
KALMAN FILTERS

O.S. Chernikova, A.K. Grechkoseev, I.G. Danchenko 32

Программирование

INTERNAL BONE MARROW DOSIMETRY: THE EFFECT OF THE EXPOSURE
DUE TO ^{90}Sr INCORPORATED IN THE ADJACENT BONE SEGMENTS

A.Yu. Volchkova, P.A. Sharagin, E.A. Shishkina 44

DECOMPOSITION OF THE PROBLEM IN THE NUMERICAL SOLUTION
OF DIFFERENTIAL-ALGEBRAIC SYSTEMS FOR CHEMICAL REACTIONS
WITH PARTIAL EQUILIBRIA

I.G. Donskoy 59

ALGORITHM FOR PROCESSING THE RESULTS OF CALCULATIONS
FOR DETERMINING THE BODY OF OPTIMAL PARAMETERS
IN THE WEIGHTED FINITE ELEMENT METHOD

V.A. Rukavishnikov, D.S. Seleznev, A.A. Guseinov 71

METHOD FOR ANALYZING THE STRUCTURE OF NOISY IMAGES
OF ADMINISTRATIVE DOCUMENTS

O.V. Slavin, E.L. Pliskin 80

Краткие сообщения

NUMERICAL METHOD FOR SOLVING THE INVERSE PROBLEM
OF NON-STATIONARY FLOW OF VISCOELASTIC FLUID IN THE PIPE

A.R. Aliev, Kh.M. Gamzaev, A.A. Darwish, T.A. Nofal 90

МЕТОДЫ ИССЛЕДОВАНИЯ УСТОЙЧИВОСТИ И СТАБИЛИЗАЦИИ
НЕКОТОРЫХ СИСТЕМ С БОЛЬШИМ ЗАПАЗДЫВАНИЕМ

Б.Г. Гребенщиков, А.Б. Ложников 99

PARALLEL DELIVERY OPERATIONS MODELLING

D.S. Zavalishchin, K.K. Vakolyuk 109

SMOOTH APPROXIMATION OF THE QUANTILE FUNCTION DERIVATIVES

V.R. Sobol, R.O. Torishnyy 115

A NEW FORMULA ON THE CONJUGATE GRADIENT METHOD
FOR REMOVING IMPULSE NOISE IMAGES

B.A. Hassan, H.M. Sadiq 123

Contents

Mathematical Modelling

APPLICATION OF RATIONAL INTERPOLATIONS FOR SOLVING BOUNDARY VALUE PROBLEMS WITH SINGULARITIES B.V. Semisalov	5
DIFFERENTIAL EQUATIONS OF ELLIPTIC TYPE WITH VARIABLE OPERATORS AND HOMOGENEOUS ROBIN BOUNDARY VALUE CONDITION IN UMD SPACES Rabah Haoua	20
TWO-STAGE PARAMETRIC IDENTIFICATION PROCEDURE FOR A SATELLITE MOTION MODEL BASED ON ADAPTIVE UNSCENTED KALMAN FILTERS O.S. Chernikova, A.K. Grechkoseev, I.G. Danchenko	32

Programming and Computer Software

INTERNAL BONE MARROW DOSIMETRY: THE EFFECT OF THE EXPOSURE DUE TO ^{90}Sr INCORPORATED IN THE ADJACENT BONE SEGMENTS A.Yu. Volchkova, P.A. Sharagin, E.A. Shishkina	44
DECOMPOSITION OF THE PROBLEM IN THE NUMERICAL SOLUTION OF DIFFERENTIAL-ALGEBRAIC SYSTEMS FOR CHEMICAL REACTIONS WITH PARTIAL EQUILIBRIA I.G. Donskoy	59
ALGORITHM FOR PROCESSING THE RESULTS OF CALCULATIONS FOR DETERMINING THE BODY OF OPTIMAL PARAMETERS IN THE WEIGHTED FINITE ELEMENT METHOD V.A. Rukavishnikov, D.S. Seleznev, A.A. Guseinov	71
METHOD FOR ANALYZING THE STRUCTURE OF NOISY IMAGES OF ADMINISTRATIVE DOCUMENTS O.V. Slavin, E.L. Pliskin	80

Short Notes

NUMERICAL METHOD FOR SOLVING THE INVERSE PROBLEM OF NON-STATIONARY FLOW OF VISCOELASTIC FLUID IN THE PIPE A.R. Aliev, Kh.M. Gamzaev, A.A. Darwish, T.A. Nofal	90
METHODS FOR STUDYING THE STABILITY AND STABILIZATION OF SOME SYSTEMS WITH LARGE DELAY B.G. Grebenshchikov, A.B. Lozhnikov	99
PARALLEL DELIVERY OPERATIONS MODELLING D.S. Zavalishchin, K.K. Vakolyuk	109
SMOOTH APPROXIMATION OF THE QUANTILE FUNCTION DERIVATIVES V.R. Sobol, R.O. Torishnyy	115
A NEW FORMULA ON THE CONJUGATE GRADIENT METHOD FOR REMOVING IMPULSE NOISE IMAGES B.A. Hassan, H.M. Sadiq	123