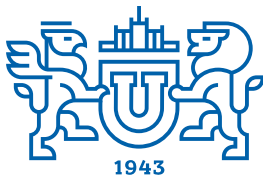


ВЕСТНИК



**ЮЖНО-УРАЛЬСКОГО
ГОСУДАРСТВЕННОГО
УНИВЕРСИТЕТА**

**2020
Т. 13, № 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., проф. **Заляпин В.И.**,
д.ф.-м.н., доц. **Замышляева А.А.**,
д.ф.-м.н., доц. **Келлер А.В.**,
д.ф.-м.н., доц. **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. **Богомолов А.В.**,
д.ф.-м.н. **Бржезинская М.М.**,
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., доц. **Корпусов М.О.**,
д.т.н., чл.-кор. РАН **Новиков Д.А.**
(*председатель*),
д.т.н., с.н.с. **Поляк Б.Т.**,
д.ф.-м.н., проф. **Пятков С.Г.**,
д.т.н., проф. **Радев Х.К.**,
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.**



BULLETIN

OF THE SOUTH URAL
STATE UNIVERSITY

2020

Vol. 13, 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 Programirovanie”

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

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
M.M. Brzhezinskaya, Helmholtz-Zentrum Berlin for Materials and Energy, Berlin, Germany
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
H.K. Radev, Technical University of Sofia, Sofia, Bulgaria
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

NUMERICAL STUDY OF THE SUSUPLUME AIR POLLUTION MODEL

S.M. Elsakov, D.A. Drozin, A.V. Herreinstein, T.G. Krupnova, S.G. Nitskaya,
T.Yu. Olenchikova, A.A. Zamyshlyayeva 5

РЕШЕНИЕ ОБРАТНЫХ СПЕКТРАЛЬНЫХ ЗАДАЧ ДЛЯ ДИСКРЕТНЫХ
ПОЛУОГРАНИЧЕННЫХ ОПЕРАТОРОВ, ЗАДАНЫХ
НА ГЕОМЕТРИЧЕСКИХ ГРАФАХ

С.И. Кадченко, А.В. Пуршева, Л.С. Рязанова 19

ТОЧНЫЕ РЕШЕНИЯ В НЕЛИНЕЙНОЙ МОДЕЛИ ТЕПЛОПЕРЕДАЧИ

А.Л. Казаков, П.А. Кузнецов 33

АНИЗОТРОПНЫЕ РЕШЕНИЯ НЕЛИНЕЙНОЙ КИНЕТИЧЕСКОЙ МОДЕЛИ
ЭЛЛИПТИЧЕСКОГО ТИПА

А.А. Косов, Э.И. Семенов 48

NUMERICAL ANALYSIS OF FRACTIONAL ORDER INTEGRAL DYNAMICAL
MODELS WITH PIECEWISE CONTINUOUS KERNELS

A. Tynda, D. Sidorov, I. Muftahov 58

Программирование

PREDICTION OF THE INTEGRATED INDICATOR
OF QUALITY OF A NEW OBJECT UNDER THE CONDITIONS
OF MULTICOLLINEARITY OF REFERENCE DATA

S.B. Akhlyustin, A.V. Melnikov, R.A. Zhilin 66

THE PYT'EV–CHULICHKOV METHOD FOR CONSTRUCTING A MEASUREMENT
IN THE SHESTAKOV–SVIRIDYUK MODEL

M.A. Sagadeeva, E.V. Bychkov, O.N. Tsyplenkova 81

TRAINING VIOLA–JONES DETECTORS FOR 3D OBJECTS BASED ON FULLY
SYNTHETIC DATA FOR USE IN RESCUE MISSIONS WITH UAV

S.A. Usilin, V.V. Arlazarov, N.S. Rokhlin, S.A. Rudyka, S.A. Matveev, A.A. Zatsarinny . . . 94

PNACO: PARALLEL ALGORITHM FOR NEIGHBOUR JOINING HYBRIDIZED
WITH ANT COLONY OPTIMIZATION ON MULTI-CORE SYSTEM

W.B. Yahia, M.W. Al-Neama, G.E. Arif 107

Персоналии

NIKOLAI ALEKSANDROVICH SIDOROV (on 80-th birthday) 119

PROF. HRISTO KIRILOV RADEV, Dsc. (November 15, 1940 – June 09, 2020) 122

Contents

Mathematical Modelling

NUMERICAL STUDY OF THE SUSUPLUME AIR POLLUTION MODEL S.M. Elsakov, D.A. Drozin, A.V. Herreinstein, T.G. Krupnova, S.G. Nitskaya, T.Yu. Olenchikova, A.A. Zamyshlyayeva	5
SOLUTION OF INVERSE SPECTRAL PROBLEMS FOR DISCRETE SEMI-BOUNDED OPERATORS GIVEN ON GEOMETRIC GRAPHS S.I. Kadchenko, A.V. Pursheva, L.S. Ryazanova	19
EXACT SOLUTIONS OF THE NONLINEAR HEAT CONDUCTION MODEL A.L. Kazakov, P.A. Kuznetsov	33
ANISOTROPIC SOLUTIONS OF A NONLINEAR KINETIC MODEL OF ELLIPTIC TYPE A.A. Kosov, E.I. Semenov	48
NUMERICAL ANALYSIS OF FRACTIONAL ORDER INTEGRAL DYNAMICAL MODELS WITH PIECEWISE CONTINUOUS KERNELS A. Tynda, D. Sidorov, I. Muftahov	58

Programming and Computer Software

PREDICTION OF THE INTEGRATED INDICATOR OF QUALITY OF A NEW OBJECT UNDER THE CONDITIONS OF MULTICOLLINEARITY OF REFERENCE DATA S.B. Akhlyustin, A.V. Melnikov, R.A. Zhilin	66
THE PYT'EV–CHULICHKOV METHOD FOR CONSTRUCTING A MEASUREMENT IN THE SHESTAKOV–SVIRIDYUK MODEL M.A. Sagadeeva, E.V. Bychkov, O.N. Tsyplenkova	81
TRAINING VIOLA–JONES DETECTORS FOR 3D OBJECTS BASED ON FULLY SYNTHETIC DATA FOR USE IN RESCUE MISSIONS WITH UAV S.A. Usilin, V.V. Arlazarov, N.S. Rokhlin, S.A. Rudyka, S.A. Matveev, A.A. Zatsarinnyy . . .	94
PNACO: PARALLEL ALGORITHM FOR NEIGHBOUR-JOINING HYBRIDIZED WITH ANT COLONY OPTIMIZATION ON MULTI-CORE SYSTEM W.B. Yahia, M.W. Al-Neama, G.E. Arif	107

Personalia

NIKOLAI ALEKSANDROVICH SIDOROV (on 80th birthday)	119
PROF. HRISTO KIRILOV RADEV, Dsc. (November 15, 1940 – June 09, 2020)	122