

IV International Conference “Supercomputer Technologies of Mathematical Modelling (SCTeMM’19)”

Journal of Physics: Conference Series Volume 1392

Moscow, Russia
19 - 21 June 2019

ISBN: 978-1-7138-1162-6
ISSN: 1742-6588

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

This work is licensed under a Creative Commons Attribution 3.0 International Licence.
Licence details: <http://creativecommons.org/licenses/by/3.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact the Institute of Physics
at the address below.

Institute of Physics
Dirac House, Temple Back
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481
Fax: 44 1 17 920 0979

techtracking@iop.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

MATHEMATICAL PROBLEMS OF CONTINUUM MECHANICS

CONTACT SYMMETRIES AND CONSERVATION LAWS OF THE FIRST ORDER OF THE EQUATION OF ONE-DIMENSIONAL SHALLOW WATER OVER A ROUGH BOTTOM IN LAGRANGE'S VARIABLES	1
<i>Alexander V Aksenov, Konstantin P Druzhkov</i>	
EQUATIONS THAT DESCRIBE WAVES IN TUBES WITH ELASTIC WALLS AND ANALYSIS OF NUMERICAL METHODS FOR REVERSIBLE AND WEAKLY DISSIPATIVE SYSTEMS	7
<i>I. B. Bakholdin</i>	
SIMULATION OF PROCESS OF SMALL SATELLITES SEPARATION FROM DEPLOYER INSTALLED ON CARGO SPACECRAFT	13
<i>N V Bogomolov, A S Anfalov, S V Borzykh, V N Bakulin</i>	
TRAJECTORY PORTRAITS FOR THE TWO PERTURBED CENTRALLY SYMMETRIC SYSTEMS OF POINT VORTICES	19
<i>V. D. Boyarintsev, T.E. Boyarintseva, N.P. Gvozdev, V.M. Kobzeva</i>	
FAR SURFACE GRAVITY WAVES FIELDS UNDER UNSTABLE GENERATION REGIMES	24
<i>V V Bulatov, Yu V Vladimirov</i>	
ON LINEAR STABILITY OF SHEAR FLOWS OF AN IDEAL STRATIFIED FLUID: RESEARCH METHODS AND NEW RESULTS	30
<i>A A Gavrilieva, Yu G Gubarev</i>	
THE SEARCH ALGORITHM FOR DISCRETE MODE OF ELECTRON PLASMA	36
<i>N M Gordeeva, A A Yushkanov</i>	
DEVELOPMENT OF COMBINED SEARCH METHODS FOR EFFICIENCY INDICATOR EXTREME IN VARIATION STATEMENT OF FORECASTING TASKS FOR DETERMINE CHARACTERISTICS OF COMPOSITE MATERIALS	42
<i>E L Gusev, V N Bakulin, V D Chernykh</i>	
ABOUT ORIENTATIONAL INSTABILITY IN NEMATIC LIQUID CRYSTAL FILMS	46
<i>A G Kalugin, D V Pavlov</i>	
AEROELASTIC STABILITY OF A SHELL SUPPORTED BY A CYLINDER WITH A HOLE OF LINEARLY VARYING RADIUS	51
<i>M A Konopelchev, V N Bakulin, A Ya Nedbai</i>	
MODEL ESTIMATES OF CIRCULATING FLOW AROUND OBJECTS IN THE MARINE MEDIUM AND ATMOSPHERE	57
<i>N.N Korchagin, I.Yu Vladimirov</i>	
NON-UNIQUENESS OF TRANSONIC FLOW IN AN INTAKE-TYPE CHANNEL	63
<i>A. Kuzmin</i>	
THE PROBLEM OF SUSPENSION INJECTION INTO A POROUS MEDIUM WITHIN A TWO-VELOCITY MODEL OF DEEP BED FILTRATION	69
<i>N E Leontiev</i>	
SOLUTION OF MODEL BOUNDARY VALUE PROBLEMS ON OSCILLATIONS OF MECHANICAL SYSTEMS WITH MOVING BOUNDARIES BY THE DUHAMEL METHOD	73
<i>Vladislav L. Litvinov</i>	
ABOUT THE ALGORITHM FOR CALCULATING THE FINAL PROBABILITIES	80
<i>A.V Mastikhin, A. A Mastikhina</i>	
CONSTRUCTION OF THE EQUATIONS OF STATE FOR POLYCRYSTALLINE SOLIDS FOR THE PURPOSE OF THE NUMERICAL SOLUTION OF PROBLEMS OF CONTINUOUS MEDIUM MECHANICS	84
<i>A V Ostriuk, D N Nikolaev</i>	
MATHEMATICAL MODELING OF CREEP AND VISCOPLASTIC FLOW OF A CYLINDRICAL LAYER MATERIAL	90
<i>L V Kovtanyuk, G L Panchenko</i>	
THE EFFECT OF AN ADDITIONAL AIR INLET IN THE HOT OUTLET AREA ON THE OVERALL EFFECTIVENESS OF A VORTEX TUBE	96
<i>L Y Privalov, C I Mikhaylenko</i>	

SIMULATION OF THE FRACTURE OF MATERIALS AND STRUCTURES UNDER DYNAMIC LOADS USING PARALLEL COMPUTING	101
<i>Pavel Radchenko, Stanislav Batuev, Andrey Radchenko</i>	
METHOD OF FINITE BODIES FOR MATHEMATICAL MODELING OF THE STRESS-STRAIN STATE OF CYLINDRICAL ORTHOTROPIC SHELL WITH THE REINFORCED RECTANGULAR HOLE.....	107
<i>Victor P. Revenko, Vladimir N. Bakulin</i>	
NEURAL NETWORK APPROACH TO SOLVING THE INVERSE PROBLEM OF SURFACE-WAVES GENERATION.....	113
<i>E.A. Voronin, V.N. Nosov, A.S. Savin</i>	
MATHEMATICAL SIMULATION OF LOCAL TRANSFER FOR NON-NEWTONIAN UID IN POROUS FABRICS	117
<i>Yu.I. Dimitrienko, Shuguang Li</i>	
ON A THEOREM OF IMPULSE AND ENERGY TO DETERMINE PARAMETERS OF THE ELECTRIC JET ENGINE KA.....	123
<i>Nikolay Sidnyaev</i>	
ESTIMATION OF MAXIMUM WATER LEVELS DURING SPRING FLOOD ON LENA RIVER PARTS USING ARTIFICIAL NEURAL NETWORKS.....	128
<i>G. P. Struchkova, T. A. Kapitonova, V. V. Timofeeva, D.D. Nogovitsyn</i>	
ESTIMATION OF NEAR-BOTTOM SUSPENSION-CARRYING FLOW AROUND A PIPELINE.....	132
<i>I.Yu Vladimirov, N.N Korchagin</i>	
ON HYPERBOLIZED NONLINEAR SCHREDINGER TYPE EQUATIONS.....	138
<i>A.D. Yunakovsky, Ya.L. Bogomolov, N.V. Sapogova</i>	

SUPERCOMPUTER TECHNOLOGIES IN RESEARCH

THE TIME REVERSIBILITY PROPERTY IN ANALYSIS OF SOUND POINTS IN BALANCE-CHARACTERISTIC DIFFERENCE METHODS.....	144
<i>N A Afanasiev, V M Goloviznin</i>	
THE ALGORITHM FOR GENERATION OF STRUCTURED GRIDS IN DEFORMED VOLUMES OF REVOLUTION.....	150
<i>A I Anuchina, N A Artyomova, V A Gordeychuck, O V Ushakova</i>	
NUMERICAL MODELLING OF WALL-BOUNDED TURBULENT FLOWS BASED ON THE CABARET SCHEME.....	156
<i>Danil Asfandiyarov</i>	
MODELS OF DYNAMICS OF CONTAMINATION PROPAGATION IN SURFACE WATERS USING SIMULATION OF HYDRODYNAMICAL PROCESSES OF DIFFERENT LEVEL OF COMPLEXITY	161
<i>Anatoly Cherepanov, Olga Sorokovikova</i>	
PROBABILISTIC MODELS OF POLLUTION OF THE SURFACE WATERS OF LARGE MARINE AREAS	167
<i>Olga Sorokovikova, Dmitry Dzama, Danil Asfandiyarov</i>	
DATA MINING USING THE THEORY COOPERATIVE GAMES IN C-CORE TO FORM CLUSTERS	173
<i>Anastasia A. Egorova</i>	
AN EFFECTIVE ALGORITHM OF THE NUMERICAL SOLUTION TO THE STEFAN PROBLEM	178
<i>Galina I. Kurbatova, Nadezhda N. Ermolaeva</i>	
HYPERBOLIC DECOMPOSITION FOR HYDROSTATIC APPROXIMATION OF FREE SURFACE FLOW PROBLEMS	184
<i>V M Goloviznin, P A Mayorov, P A Mayorov</i>	
THE BALANCE-CHARACTERISTIC NUMERICAL METHOD ON TRIANGLE GRIDS.....	190
<i>D Y Gorbachev, V M Goloviznin</i>	
CUDA UNIFIED MEMORY ACCELERATION OF THE PROCESS OF DEVELOPING MULTI-GPU APPLICATIONS.....	196
<i>A Y Gorchakov, A V Solovjev</i>	
APPLICATION OF NON-STATIONARY GAS DYNAMIC FUNCTIONS FOR MATHEMATICAL MODELING OF GAS DYNAMIC PROCESSES.....	202
<i>Y A Grishin, V N Bakulin</i>	

MATHEMATICAL MODELLING OF HYDROGEN SAFETY PROBLEMS WITH CABARET SCHEME	208
<i>A.A. Kanaev, V.Yu. Glotov, V.M. Goloviznin, V.G. Kondakov, A.E. Kiselev</i>	
ALGORITHMS FOR NUMERICAL SOLUTION OF INTEGRAL EQUATIONS OF THREE-DIMENSIONAL SCALAR DIFFRACTION PROBLEM	214
<i>A A Kashirin, S I Smagin</i>	
LAGRANGE-EULERIAN METHOD FOR NUMERICAL INTEGRATION OF THE GAS DYNAMICS EQUATIONS: PARALLEL IMPLEMENTATION ON GPUS	220
<i>Sergey Khrapov, Alexander Khoperskov, Sergey Khoperskov</i>	
MATHEMATICAL MODELING OF FREE-SURFACE FLOWS USING MULTIPROCESSOR COMPUTING SYSTEMS	226
<i>V A Gushchin, V G Kondakov</i>	
CALCULATION OF CURRENT DISTRIBUTION IN TUNGSTEN PLATE UNDER EXPOSURE TO A PULSED ELECTRON BEAM	232
<i>G.G. Lazareva, A.S. Arakcheev, V.A. Popov, A.G. Maksimova, E.S. Kapina</i>	
NUMERICAL MODEL FOR CALCULATING DISPLACEMENTS NEAR A CRACK	238
<i>A.G. Maksimova, A.S. Arakcheev, G.G. Lazareva</i>	
THERMAL ACTION OF PULSE RADIATION ON THE CARBON CONIC SHELLS LOADED WITH INTERNAL PRESSURE	243
<i>A M Matveenko, A V Ostrik, V N Bakulin</i>	
VERIFICATION OF THE CABARET SCHEMES FOR THE SHALLOW WATER EQUATIONS BASED ON THE CONSERVATION OF ANGULAR MOMENTUM	249
<i>V.M Goloviznin, A.V Solovjev, V.B Zalesny</i>	
NUMERICAL SIMULATION OF A SPATIAL – TEMPORAL MODEL OF EPIDEMIC DISTRIBUTION	255
<i>T.S. Timofeeva, I. Farago, E.L. Kim</i>	

COMPUTATIONAL ALGORITHMS FOR SOLVING APPLIED PROBLEMS

AN ALGORITHM TO IDENTIFY TEXT MARKED IN ROCK CORE PICTURES WITH MACHINE LEARNING ALGORITHM	261
<i>Yunfeng Bai, Vladimir Berezovsky</i>	
3-D ELECTRONIC DENSITY MAPS FOR ENZYME REACTION INTERMEDIATES: BIG DATA AND HIGH PERFORMANCE COMPUTING SERVICES IN A VIRTUALIZED ENVIRONMENT	267
<i>Anton Brekhov, Vladimir Mironov, Alexander Moskovsky, Dmitry Podgainiy, Oksana Streltsova, Dmitry Delyakov</i>	

HIGH PERFORMANCE COMPUTING SOFTWARE

ESTIMATION OF PARAMETERS OF GAS DIFFUSION IN MODELS OF MICROTRANSFACTIONS OF DIFFERENT TYPE BY THE METHOD OF MOLECULAR DYNAMICS	270
<i>M.Yu. Antonov, A.V. Popinako, A.V. Grigoriev, I.N. Nikolaev</i>	
DIGITAL TWINS OF MULTISCALE 3D HETEROGENEOUS GEOLOGICAL OBJECTS: 3D SIMULATIONS AND SEISMIC IMAGING OF FAULTS, FRACTURES AND CAVES	278
<i>Vladimir Cheverda, Vadim Lisitsa, Maksim Protasov, Galina Reshetova, Boris Glinsky, Igor Chernykh, Anastasiya Merzlikina, Victoria Volyanskaya, Denis Petrov, Artjem Melnik, Valery Shilikov</i>	
SUPERCOMPUTER TECHNOLOGIES FOR SOLVING PROBLEMS OF COMPUTATIONAL PHYSICS	284
<i>Boris Glinsky, Yury Zagorulko, Igor Kulikov, Anna Sapetina</i>	
NUMERICAL SOLUTION OF THE INVERSE COEFFICIENT PROBLEM OF FILTRATION IN A MULTILAYER RESERVOIR	290
<i>M. Kh. Khairullin, E. R. Badertdinova, R. M. Khairullin</i>	
ALGORITHM FOR RESTORATION OF FRICTION POWER IN DRUM BRAKE DEVICE WITH A LAYER FROM THE COMPOSITIONAL MATERIAL ON TEMPERATURE DATA	295
<i>A S Kondakov</i>	
PARALLEL COMPUTING APPLIED TO THE MOLECULAR DYNAMICS SIMULATIONS	301
<i>Victor L. Malyshev, Elena F. Moiseeva</i>	
VIRTUAL STREAM COMPUTING SYSTEMS WITH A FUZZY COMPUTING ENVIRONMENT	307
<i>A.V Myshev</i>	

MATHEMATICAL MODELING OF THE DYNAMICS OF LAYERED AND BLOCK MEDIA WITH NONLINEAR CONTACT CONDITIONS ON SUPERCOMPUTERS.....	312
<i>I. S. Nikitin, N. G. Burago, V. I. Golubev, A. D. Nikitin</i>	
MATHEMATICAL MODEL OF DECOMPOSITION OF HYDRATES IN A RESERVOIR	318
<i>V.V Popov</i>	
MATHEMATICAL TECHNOLOGY FOR SOLVING THE KARDAR-PARISI-ZHANG EQUATION WITH A SOURCE	324
<i>A E Rassadin, A V Stepanov</i>	
SOLUTION OF TWO-PHASE NONISOTHERMAL FLUID FLOW PROBLEM WITH NONLINEAR FILTRATION LAW ON HETEROGENEOUS COMPUTING SYSTEMS.....	330
<i>A V Tsepaev</i>	
PROPAGATING LARGE OPEN QUANTUM SYSTEMS TOWARDS THEIR ASYMPTOTIC STATES: CLUSTER IMPLEMENTATION OF THE TIME-EVOLVING BLOCK DECIMATION SCHEME	336
<i>Valentin Volokitin, Ihor Vakulchuk, Evgeny Kozinov, Alexey Liniov, Iosif Meyerov, Michail Ivanchenko, Tatyana Laptyeva, Sergey Denisov</i>	
HIGH THROUGHPUT CALCULATIONS AS AN ELEVATOR ON THE WAY FROM CHEMICAL STRUCTURE TO NOVEL MATERIALS	342
<i>I.D. Yushina, G.I. Makarov, Y.V. Matveychuk, E.V. Bartashevich</i>	
 <u>MULTISCALE MODELS AND METHODS</u>	
MULTISCALE SIMULATION OF THE HEAT AND MASS TRANSFER WITH BRINKMAN MODEL	348
<i>Valentin Alekseev, Maria Vasilyeva, Vasily Vasiliev</i>	
QUASI-CELLULAR NETS BASED MODELS OF FLOW SYSTEMS	355
<i>Anton O. Aristov</i>	
BLOCK FINITE-ELEMENT APPROACH TO BUILDING REFINED MODELS OF LAYER-BY-LAYER ANALYSIS OF THE STRESS-STRAIN STATE OF THREE-LAYER IRREGULAR SHELLS.....	360
<i>V N Bakulin</i>	
HOMOGENIZATION OF THE ELASTICITY PROBLEM WITH PERIODICALLY LOCATED CRACKS	366
<i>Alena A. Egorova, Natalia V. Neustroeva, Nadezhda M. Afanaseva</i>	
MULTISCALE FINITE ELEMENT METHOD FOR SCATTERING PROBLEM IN HETEROGENEOUS DOMAIN	372
<i>Uygulaana Gavrilieva, Maria Vasilyeva, Isaac Harris, Eric T. Chung, Yalchin Efendiev</i>	
NEURAL NETWORKS FOR MULTICONTINUUM MODELS	378
<i>A. Grigorev, S. Stepanov, Dj. Nikiforov</i>	
EFFECTIVE CALCULATION OF THERMOPHYSICAL PROPERTIES OF COMPOSITE MATERIALS WITH MULTIPLE CONFIGURATIONS BY ASYMPTOTIC HOMOGENIZATION TECHNIQUE	384
<i>Vasily Grigoriev, Petr Zakharov, Mir Akimov</i>	
GPU-ACCELERATED DISCRETE ELEMENT MODELING OF GEOLOGICAL FAULTS	389
<i>V. Lisitsa, V. Tchebverda, V. Volianskaia</i>	
GMSFEM ON UNSTRUCTURED GRIDS FOR SINGLE-PHASE FLOW IN FRACTURED POROUS MEDIA	395
<i>Djulustan Nikiforov, Maria Vasilyeva, Yalchin Efendiev, Vasily Vasil'ev</i>	
SCALING IN SUPER ELEMENT MODEL OF PETROLEUM RESERVOIRS	400
<i>Alexandr Mazo, Konstantin Potashev</i>	
FINITE-ELEMENT MODELING OF CRITICAL LOADS OF BUCKLING OF STRUCTURES CONSIDERING OF NONLINEARITY OF PRE-BUCKLING STATE	406
<i>V V Repinskii, V N Bakulin</i>	
NUMERICAL HOMOGENIZATION OF ELASTOPLASTIC DEFORMATIONS OF COMPOSITE MATERIAL WITH SMALL PROPORTION OF INCLUSIONS	412
<i>Petr V. Sivtsev, Aleksandr E. Kolesov, Petr E. Zakharov, Ying Yang</i>	
EMBEDDED FRACTURE MODEL IN NUMERICAL SIMULATION OF THE FLUID FLOW AND GEO-MECHANICS USING GENERALIZED MULTISCALE FINITE ELEMENT METHOD	418
<i>Aleksei Tyrylgin, Maria Vasilyeva, Eric T. Chung</i>	
NUMERICAL CALCULATION OF SPECTRAL PROBLEMS IN SP_3 APPROXIMATION BY FEM.....	424
<i>A. O. Vasilev, A. V. Avvakumov, V. F. Strizhov, P. N. Vabishchevich</i>	

ANALYTICAL MATRIX SOLUTIONS OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS	430
<i>Y I Vinogradov, D B Molchanov, V N Bakulin</i>	
COMPARISON OF DISCRETE FIBER AND ASYMPTOTIC HOMOGENIZATION METHODS FOR MODELING DEFORMATIONS OF FIBER-REINFORCED MATERIALS	435
<i>Petr E. Zakharov, Petr V. Sivtsev</i>	

NUMERICAL METHODS FOR SOLVING INVERSE PROBLEMS

DEVELOPMENT OF ALGORITHMS FOR THE FORMATION OF STEADY-STATE MODES BASED ON THE TOPOLOGY OF ELECTRIC POWER SYSTEMS	441
<i>D S Akhmetbaev, A R Dzhandigulov</i>	
DATA SPACE REFLECTIVITY FULL WAVEFORM INVERSION.....	445
<i>Kirill Gadylshin, Vladimir Tcheverda</i>	
NUMERICAL METHOD FOR RECOVERING THE PIECEWISE CONSTANT RIGHT-HAND SIDE FUNCTION OF AN ELLIPTIC EQUATION FROM A BOUNDARY OVERDETERMINATION DATA.....	451
<i>D Kh Ivanov, A E Kolesov, P N Vabishchevich</i>	
STUDYING OF THE STABILITY OF THE FLOW RATES WELLS UNTO ERRORS PERMEABILITY FIELD IDENTIFICATION UNDER CONDITIONS OF SINGLE-PHASE STATIONARY FLUID FILTRATION	457
<i>A V Elesin, A Sh Kadyrova, A I Nikiforov</i>	
A COMPUTATIONAL ALGORITHM FOR CONSTRUCTING A TWO-DIMENSIONAL HEAT WAVE GENERATED BY A NON-STATIONARY BOUNDARY CONDITION	463
<i>A L Kazakov, L F Spevak, A A Lempert, O A Nefedova</i>	
RECOVERY OF A PIECEWISE CONSTANT LOWER COEFFICIENT OF AN ELLIPTIC EQUATION	469
<i>A E Kolesov, D Kh Ivanov, P N Vabishchevich</i>	
IDENTIFICATION OF PARAMETERS OF ADAPTIVE TIME SERIES MODELS	475
<i>V. D. Polezhaev, K. O. Yusupova</i>	
MANAGEMENT OF THERMAL PROCESS FOR POLYETHYLENE GAS PIPES WELDING WITH BUILT-IN HEATER	482
<i>N P Starostin, M A Vasileva, O A Ammosova</i>	
IDENTIFICATION OF THE SPACEWISE DEPENDENT RIGHT-HAND SIDE IN ONE-DIMENSIONAL PARABOLIC EQUATION	488
<i>Ling De Su, V. I. Vasil'ev</i>	
MODELING OF BURDEN AT AUTOMATED STRENGTH CALCULATION OF MOBILE VEHICLES SUPPORTING STRUCTURES	494
<i>M Tokareva, T Zubkova</i>	
NUMERICAL IDENTIFICATION OF THE INITIAL CONDITION FOR PARABOLIC EQUATION	500
<i>V.I. Vasil'ev, M. Kardashevsky</i>	
IDENTIFICATION OF HEAT EXCHANGE BOUNDARY CONDITIONS AT VARIOUS NATURAL AND TECHNOGENIC FACTORS	507
<i>T.A Vinokurova, P.P Permyakov</i>	

Author Index