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Numerical and experimental research of high-rise buildings and structures aerodynamics in the presence of environmental building

The methodology of TsAGI's T-1-2 wind tunnel testing of the high-rise building models aerodynamics in presence of environmental building in case of near ground wind profile and uniform stream within the requirements of the regulatory framework is given.

Key words: wind-tunnel experiment methodology, simulation of buildings and structures aerodynamics, ground wind layer, computational fluid dynamics.

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Theoretical bases of the speckle-holography method in experimental mechanics

The paper presents a mathematical model of the holographic and speckle-interferometry physical phenomena combining geometric and diffraction optics theories. The model is used in experimental mechanics for space displacement and deformation full-scale construction analysis. A new possibility to investigate a wide range of problems is offered.

Key words: speckleholography, specklestructure, diffracted and computer's optics, diffractive grids, diffraction halo, Fourier transformation, optical filtration, optical differentiation, experimental mechanics.

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Points of minimum pressure in the axisymmetric fluid flows

It is shown that in the absence of braking points in the bounded region of the axisymmetric vortex flow of an ideal incompressible fluid pressure reaches a minimum value in the boundary region. The violation of this property of pressure indicates the presence of braking points. The result can be used to verify numerical calculations of the flow for streamlined bodies.

Key words: Euler equations, vortex flow, minimum principle for the pressure, axisymmetric flow, incompressible fluid.

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Control system algorithm for the aircraft carrier landing

The complexity of aircraft carrier landing is based on the following factors requirement for high precision of landing with hook touch in the band contact of arrester cable, execution of landing in carrier rolling conditions and air turbulence in the carrier trail. This study deals with standard algorithm changes of the aircraft control system in the gallery in landing mode by using feedback for the pitch angle increment and the regulating capability of the gear ratio from the aircraft pitch control to stabilizer only in this flight mode. The changes in the proposed aircraft control system are approved by carrier landing simulation (modelling) on the test equipment.

Key words: carrier, arrester, carrier landing, control system.

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Nonlinear model in the Forchheimer stationary two-dimensional pressure filtration of liquid to wells

We consider the problem of stationary two-dimensional pressure filtration of an incompressible fluid to the bore for the Forchheimer nonlinear law. The radial case is reduced to the Dupuis engineering formula for the flow rate expression. We define pressure and velocity fields. In the case of an arbitrary circuit, we obtain the resulting nonlinear second order equation that is a generalization of the two-dimensional Laplace's equation which is convenient to generalize the notion of the horizontality effect.

Key words: nonlinear filtration, well production rate, formula type Dupuis, external boundary.

On well tests features in the low-permeability reservoirs

In this paper, features of wells performance tapping low-permeability reservoir are considered. In these wells, the anomalous bottomhole pressure decline rate is observed and, as a consequence the small cumulative production, reserves-to-production ratio. Several reasons for this phenomenon are considered, arguments for and against each of them are made. Following the examination of these reasons, the hypothesis of nonlinear filtration present in low-permeability reservoirs is adopted. For correct prediction of the bottomhole pressure and fluid rate behaviour, a program is created that allows us to perform computations of reservoir engineering, where filtration does not obey the Darcy law. Obtained results are compared using known analytical solutions and field data. The result of this work is a tool for reliable predictions of wells and pads performance and an interpretation technique of well testing results under nonlinear filtration.

Key words: low-permeability reservoir, nonlinear filtration, well tests, numerical simulation.

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Polarization bremsstrahlung taking into account the plasmonic interference effects of fast electrons on metallic nanospheres in a dielectric matrix

The paper is devoted to the theoretical analysis of polarization bremsstrahlung (PB) [1] due to the scattering of fast electrons by a metal nanosphere embedded in a dielectric matrix in the frequency region in the vicinity of dipole and quadrupole plasmon resonances. Here we take into account plasmon interference effects that arise in the frequency-angular distribution of PB. These effects result from interrelation between contributions to PBs due to a plasmon on the sphere surface of different multipolarity. Our approach is based on the Fermi method of equivalent photons [2] and the Mie theory of radiation scattering by small metal particles [3]. It is shown that taking into account the plasmon interference in the PB differential crosssection results in specific features in the spectral distribution of an emitted photon which strongly depend on the radiation angle and nanosphere radius.

Key words: polarization bremsstrahlung, fast electrons, metallic nanosphere, plasmons.

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Resistive-barrier discharge in atmosphere for short interelectrodes gaps for «needle-to-plate» system

The results of experimental investigations of the resistive barrier discharge (RBD) in normal laboratory conditions ($P = 1 \text{ atm}$, $T = 300 \text{ K}$, $H = 40\%$) are given. The resistive-barrier discharge is different from the standard corona discharge with similar electrodes' geometry. The noncoroning electrode is covered by a layer of low-conductive material (electrical conductivity $\delta \sim 10^{-6} (\text{OM} \cdot \text{M})^{-1}$). The resistive barrier helps us to form stable discharge for short inter-electrodes gaps (less than 3 mm), which is impossible in the standard corona discharge. Current voltage, temporal and spatial characteristics are investigated.

Key words: Gas discharge, resistive barrier, «needle-to-plate» system.

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Selfconsistent potential for the halo nucleus ^{11}Be

The new model of a single-particle self-consistent potential for the nucleus ^{11}Be is suggested. It consists of the well-known spherical oscillator potential and a new strong short-range potential. This model allows us to explain the energies of the ground state and the first excited state. The conclusion of the strong nonuniformity of nuclear matter in the nuclear core ^{10}Be has been made. It is explained by the strong mutual attraction of nucleons. As a result, the density of nucleons in the center of the nucleus is much greater than that on the nuclear surface.

Key words: self-consistent potential, nuclear levels, atomic nuclei, halo neutrons.

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Nonzero minimum of the square of the gradient of a harmonic function

Harmonic functions in arithmetic Euclidean spaces of dimension four and higher are considered. For each dimension $n > 3$ the existence of a function whose square of the gradient reaches a non-zero strict local minimum at the inner point of the harmonicity domain of this function is proved. (A similar example for the three-dimensional case is known earlier.) This proves the impossibility of extending the two-dimensional minimum principle to multidimensional (three or more) cases. According to this principle, the modulus of the gradient of two variables function at the inner point of the harmonicity domain cannot reach a strict local nonzero minimum.

Key words: gradient of a harmonic function, minimum principle.

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On the traces of G -operators supported on submanifolds

We study traces of operators associated with actions of compact Lie groups. In the situation when the trace is supported in a submanifold of fixed points of the action, we prove that the trace is a pseudodifferential operator. As a corollary, we prove finiteness theorem and construct Fredholm riggings of the obtained traces.

Key words: elliptic operators, Sobolev problems, fixed points, Lie group action, Fredholm riggings.

**On the research and academic activity
of the honoured worker of science of the Russian Federation
of the Professor of the Radio Engineering and Control Systems Department
of Moscow Institute of Physics and Technology (State University)
of Gabidulin Ernst Mukhamedovich**

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Optimal and suboptimal subspace codes-spreads

This paper is devoted to subspace codes with maximal code distance which are known as spreads. The multicomponent codes with zero prefix (MZP) are presented. Cardinality for different parameters is calculated. The obtained values of cardinality are compared with the upper bound. It is shown that the cardinality of MZP codes-spreads coincides with the upper bound under some conditions and near the upper bound under other conditions. In the first case they are called optimal subspace codes, in the last case they are called suboptimal subspace codes. The efficiency η of suboptimal codes is estimated as a ratio of two values which are the cardinality of the code and the upper bound. This ratio is $\eta \geq 0.99$ for many parameters.

Key words: finite field, code, decoding, space, subspace, code cardinality, rank metric.

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Security Code LTD

New algorithm for formation of certificate revocation lists

This paper discusses the optimization of the size of lists of revoked certificates that are used in the public key infrastructure. A new algorithm for formation of lists of revoked certificates and an algorithm based on it for formation of archival electronic signature formats are presented.

Key words: information security, PKI, CRL, electronic signature, cryptography.

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Method for improving efficiency of voice control based on the complementary ensemble empirical mode decomposition

The low accuracy of voice recognition is one of the main problems of practical implementation of voice control systems (VCS). It is associated with the use of inefficient and non-adaptive methods for speech signal processing. An improved algorithm for recognizing voice commands using the adaptive processing technology of the complementary ensemble empirical mode decomposition (CEEMD) is proposed. The block diagram and detailed mathematical description of basic blocks of the algorithm are given. A distinctive feature of the proposed algorithm is to extract only useful information of the unique properties of voice from the original speech signal. The experimental results of the proposed algorithm show the improved accuracy of voice commands recognition and efficiency of voice control as compared to the known RWTH ASR, Julius, and CMU Sphinx analogues.

Key words: voice control, VCS, speech signals processing, CEEMD, mel-frequency cepstral coefficients (MFCC).

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Cortex searching engine

The paper discusses the principle of work of searching engine. Cortex, which is based on an increase in the productivity and reliability of work at the expense of a considerable quantity of the cheap personal computers united in one local network and operated server. Principles of formation of inquiries in the final personal computer, methods for processing of answers are described. In the article, the method for search of malfunctions and their automatic correction by introduction in operation of reserve computers is also described.

Key words: search engines, Cortex, parallel calculations, converse sets.

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Registrar parameters building technology of a digital control system on the basis of ferroelectric nonvolatile memory

The paper considers an approach to the construction of an autonomous parameter recorder based on FRAM with a unified data structure. The proposed registrar has an additional functional and technological capabilities: autonomy, versatility architecture, the ability to save several recent data frames, up to the accident, flexible setting of the data selector, the ability to remotely change operating modes.

Key words: node of registration parameters, autonomous registrar, data structure, consistent information environmen, FRAM.

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Neural network approaches to the classification of texts based on morphological analysis

In this paper, the main purpose is to consider applications of morphological analysis in text classification. Morphological analysis helps us to learn grammatical features of words, grammatical semantic and the interaction between the elements of text. We propose the neurosemantic network based on morphological analysis for learning vector representations of the text's grammatical structures and the recursive autoencoder that consists of two parts - the first part combines two vectors of words, the second one combines two vectors of morphology.

Key words: classification, morphology, neural network

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On-chip network design for prospective chip multiprocessors

The paper is dedicated to the problem of the efficient on-chip interconnection of a high performance many-core microprocessor with distributed shared cache. Packet injection rate, latency, Quality of Service and in-order delivery are the main concerns. A solution is proposed employing mesh topology, row-column decoupling, and Express Virtual Channels with starvation avoidance mechanism improvements. Throughput, fairness, latency and silicon area of the proposed scheme and a few traditional ones are evaluated for network sizes from 4×4 to 16×16 . The proposed scheme is the only one to demonstrate all of the required qualities in conjunction with good scalability.

Key words: on-chip interconnect, NoC, Elbrus, architecture, many-core, memory subsystem, shared cache, NUCA.

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Gesture recognition by neural network and its implementation for the new generation of interactive gadgets for children

The article deals with the problem of recognizing gestures performed by a stick, which is in the person's hand on the basis of data stream analysis from the inertial measurement unit module inside the stick. The Long shortterm memory (LSTM) neural network is used for analysis. The results of four simplest gestures recognition experiment are presented. For the results of recognition, the common quality metrics are presented.

Key words: gesture recognition, IMU, LSTM neural network, magic stick.

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Comparative estimation of network adaptability by overloaded connections on an example of a chain of maps

The paper investigates the basic ideas of the new concept for the suspected comparative assessment of network adaptivity with random topology. Inherently, this approach shows the network equality and disordered assembly of chained visualizations. The structure of the network constrains is always possible to submit in matrix form. The paper presents a constructing algorithm for the logic visualization assembly with constrains matrix, which is structurally coupled to the elucidated network. It is claimed that the analysis of the disordered assembly congestion allows us to make a tentative assessment of network adaptivity with corresponding random topology. The approach is applied to networks with flat and simple ring topology in the present article. We illustrate the nonsensitivity of the approach to other features of the disordered assembly besides the congestion. It is apparent that for rather long chains and rings the adaptivity does not depend on a number of nodes. The hierarchy rate between dynamicity crack speeds for different visualizations chains configurations is deduced and interpreted.

Key words: adaptivity, network theory, chaotic ensembles, logistic parabola, connection overload, nonlinear dynamics, bifurcations