G. I. Turkanov[1], *E. V. Scepin*[1,2]

[1]Moscow Institute of Physics and Technology (State University)
[1,2]Steklov Mathematical Institute of Russian Academy of Sciences, Moscow, Russia

Bayes classifier for a variable number of features

The ranking approach using the Bayesian classifier for a variable number of features with the factual theory, which allows us to add more information to the classifier - characteristics of selfsimilarity. For this the Naive Bayes classifier is modified and defins Hurst data that is associated with traditional fractal dimension.

Key words: Bayesian classifier, machine learning, ranking, Hurst exponent, fractal dimension, prediction, computational experiment.

A. A. Khlinov

Radio Research and Development Institute
Moscow Institute of Physics and Technology (State University)

Optimized min-sum decoding algorithm for LDPC-codes

In this paper, the simulation of a lowdensity LDPC-code with AWGN is presented. The error performance of the min-sum decoder with normalization factors is showen. LDPC uses an implementation of the decoder based on the min-sum method with linear correction of node metrics. Some simulation results are given, which show that the error performance of the optimized min-sum decoder is close to that of the sumproduct decoder. An optimized decoder is suitable for implementation on FPGAs as well as an ordinary min-sum decoder.

Key words: norm min-sum, decoder, LDPC, FPGA.

K. N. Ziza[1], *V. V. Shtepin*[2]

[1]Donetsk National University
[2]Moscow Institute of Physics and Technology (State University)

Geometric realizations of irreducible representations of three–dimensional regular polyhedra rotations groups

The new geometric realizations of irreducible representations of regular polyhedra rotations groups in three dimensions are found in the work. The formula for projecting operators in canonical decomposition of the induced representation is suggested for constructing realizations of irreducible representations in complex-valued functions on vertexes, edges and verges of polyhedra.

Key words: group, rotation, regular polyhedra, homogeneous space, induced representation, irreducible representation, spectrum of representation, realization of representation, operator, projector, basis.

V. M. Imaykin

Volgograd State University

Soliton-type asymptotics of solutions to hyperbolic equations with finite-dimensional nonlinear perturbations

The overview of methods and results of soliton type asymptotics of solutions to hyperbolic equations with finite dimensional nonlinear perturbations. The systems describe an interaction of the either wave field or Klein–Gordon field or Maxwell field with a charged particle. We consider in detail the weak interaction case and the charge density case which satisfies a special Wiener condition.

Key words: Systems of wave-particle interaction, soliton-type solutions, long time soliton-type asymptotics, weak interaction, Wiener condition.

I. V. Matyushkin [1,2], *G. Ya. Krasnikov*[1,2], *N. V. Chernyaev* [1], *E. S. Gornev* [1,2], *N. V. Evstratov* [1,2]

[1]Molecular Electronics Research Institute JSC
[2]Moscow Institute of Physics and Technology (State University)

Numerical Investigation of Parametric Properties of Particular Sturm-Liouville Equation Solution

A particular kind of the Sturm-Liouville equation, which is earlier derived from the solvation of Maxwell's equations for electromagnetic waves propagating in nonstationary medium is studied. The influence of nonstationary parameters on harmonic and end equation properties is studied in linearized linear exponential and harmonic cases. The proposed technique of magnitude and phase extraction at the right end of segment allows us to find the quasiperiodicity and deterministic chaos phenomenon, which we call «arch effect».

Key words: Maxwell's equations, Sturm-Liouville equation, permittivity.

V. A. Astapenko, E. S. Manuylovich

Moscow Institute of Physics and Technology (State University)

Interaction of electromagnetic pulses with the Fano resonance in photonic crystals

The interaction of electromagnetic pulses of finite spectral width with structures exhibiting dispersion properties of the Fano resonance type is considered by the example of a photonic crystal waveguide with special inserts defects. The number of photons passing through the waveguide and integrated transmittance depending on the width of the resonance and the reflection coefficient of partially reflecting elements is calculated for pulses of varying duration.

Key words: photonic crystal, Fano resonance, dispersion.

A. V. Panchenko[1], *F. F. Kamenets*[1], *S. V. Bulanov*[2,3]

[1]Moscow Institute of Physics and Technology (State University)
[2]Kansai Photon Science Institute, JAEA, Kizugawa, Kyoto 619-0215, Japan
[3]A. M. Prokhorov Institute of General Physics of RAS

Laser acceleration from thin-foil targets

The relativistic flying mirror model in laser plasma is studied with account taken of its transparency. Conclusions on laser acceleration effectiveness in radiation damping regime are made.

Key words: laser acceleration, relativistic electron mirrors, relativistic optics and engineering.

B. I. Basok, V. V. Gotsulenko

Institute of Engineering Thermophysics of National Academy of Sciences of Ukraine

Selfoscillations of gas caused by combustion heat or convective heat supply

The mathematical model of unsteady motions of a real gas when approaching the local heat over the surface is used. Equations of motion are concretized for the considered distribution problem (heart dissipation tensor) associated with the heat surface and characterized by a negative thermal resistance. The general equation for the components of this tensor is used. Also, its application to determine thermosacoustic longitudinal oscillations in Rijke's tube is discussed.

Key words: tensor heat dissipation, «negative» thermal resistance, thermoacoustic selfoscillation, Rijke's tube.

K. D. Bukharov

Moscow Institute of Physics and Technology (State University)
FGUP «Central Aerohydrodynamic Institute»

Optimization technique of performance characteristics of the air flow speed control system for a subsonic wind tunnel

The paper focuses on the optimization technique of performance characteristics of the air flow speed control system for subsonic wind tunnel based on the Lagrange problem solution for the third order system of differential equations with constant coefficients.

Key words: mathematical model, airspeed control system, Lagrange problem, wind tunnel.

V. N. Golubkin[1,2], *G. B. Sizykh*[1]

[1]Moscow Institute of Physics and Technology (State University)
[2]Cent Aerohydrodynam Inst TsAGI

Property of the extreme pressure values in plane subsonic flows

Based on the analysis of the Euler equations, a steady plane subsonic flow of an ideal perfect gas is investigated. The flow in a bounded area is considered. The vorticity vector can be nonzero. It is assumed, that the pressure in the area under study is not constant, and parameters of the flow (velocity components, density and pressure) are twice continuously differentiable. The conclusion is: if the velocity does not vanish, the pressure maximum and minimum are achieved at the boundary and only at the boundary of the area. The violation of this property of the extreme pressure values is a sufficient indication of the presence of a stagnation point or a sound point.

Key words: Euler equations, subsonic flow, vortex flow, property of the extreme pressure values.

A. A. Romanov[1], *D. A. Shpotya*[2]

[1]Joint Stock Company «Russian Space Systems»
[2]Moscow Institute of Physics and Technology (State University)

Method of Determining the Most Important Engineering Product Attributes as The Basis for Identification of Critical Technologies

The need to identify critical technologies (ICT) is studied. Estimation of the most important engineering attributes using the project management approach, product lifecycles (PLC) and system engineering (SE) tools is considered to be the first important step before ICT. The conventional SE tool quality function deployment (QFD) is emphasized as a basic tool. QFD consists of four phases («Houses of Quality»). The authors' research shows that the identification of critical technologies is possible during the second QFD phase. The second phase must be initiated once the first one is completed. The first phase has organizational and methodological disadvantages. Overcoming of these disadvantages allows the authors to propose an engineering technique called the «Improved QFD» (IQFD). The authors describe the development process of the first PLC stage «concept development» of «Mayak» nanosatellite as a demonstration of IQFD functions: development of customer requirements, numeric fixing of correlations among engineering attributes in the house of quality, utilization of determined weights of correlations during the final QFD ranking of each technical attribute. IQFD ranking results are different from QFD results. QFD and IQFD results analysis and the comparison of these results with a physical workflow of «Mayak» engineering verify and validate the correctness of IQFD results and inaccuracy of QFD results.

Key words: systems engineering, critical technologies, Quality Function Deployment, QFD, Analytical Hierarchy Process, AHP, Kano model.

Y. I. Skalko

Moscow Institute of Physics and Technology (State University)

Riemann problem of a discontinuity decay in the case of several spatial variables

The paper presents the solution of the generalized Riemann problem of a discontinuity decay of for hyperbolic systems of linear first order differential equations with constant coefficients and any number of spatial variables. The proposed algorithm reduces the problem of finding the values of the variables in both sides of the discontinuity surface of the initial data to the system of algebraic equations with the right-hand side depending on the values of the variables at the initial time in the finite number of points.

Key words: decay gap, junction conditions, hyperbolic systems, generalized functions, Cauchy problem, Green's matrix function, characteristics, Riemann invariants, elastic dynamics equations.

E. V. Streltsov

Central Aerohydrodynamic Institute named after N.E. Zhukovsky
Moscow Institute of Physics and Technology (State University)

Numerical simulation of flow in low-interference transonic wind tunnels with the controlled boundary layer on solid walls

Traditional boundaries of transonic wind tunnels (perforated and slotted walls) have some disadvantages that do not allow us to completely remove wall interference in all main aerodynamic characteristics. This article focuses on the numerical simulation of a new boundary condition based, in general, on the idea of jet boundaries. The author examines the implementation of the controlled boundary layer on solid walls which thickness is artificially increased.Analysis emphasizes a significant decrease in the wall interference on all main aerodynamic characteristics, including the lift coefficient and the pitching moment coefficient. Realization of the controlled boundary layer might become a simple and rather efficient method of wall interference reduction.

Key words: numerical simulation, wall interference, boundary layer, wind tunnel.