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DYNAMICS OF THE DAVYDOV-SCOTT SOLITONS AT SPACE-SPEED DISPLACEMENT OF THE SOLITON'S COMPONENT

Purpose: The dynamics of the two-component (vector) Davydov-Scott (DS) solitons with a space-speed displacement of high-frequency (HF) and low-frequency (LF) component. Investigation was conducted in the framework of Zaharov type system of two coupled equations for HF and LF field. In this system, the HF field is described by the linear Schrodinger equation with variable in time and space potential, caused by LF component. LF component in this system is described by Boussinesq or Korteweg-de Vries equation with a quadratic (striction) action to HF fields.
Approach: The investigation was considered as analytically as numerically.
Findings: Analytically, using the method of wave field integrals found frequency of spatially-speed oscillation HF components of the vector soliton DS. The analytical results are confirmed by a numerical simulations.
Key words: linear schrodinger equation, boussinesq equation, Korteweg-de Vries equation, soliton, dispersion, nonlinearity, numerical simulation.

V.M. Galkin

MATHEMATICIAN LEARNS PHYSICS

Purpose: The questions of teaching that represent some difficulties for the students with different types of thought are putting up.
Design: For illustration the examples from thermodynamics and hydrodynamics are chosen.
Findings: The standard exposition of second law of thermodynamics is critized. Also the vagueness in raising of the basic problems at the study of flow of ideal fluid are remarking.
Research: The article will be interesting to the teachers and the students of technical universities.
Originality: The article has discussing character.
Key words: entropy, differential form, exact form, ideal fluid, Euler equation.

D. E. Krasilnikov

THE ALGORITHM OF SAMPLE DETERMINATION COEFFICIENT CALCULATION IN MS-EXCEL

Abstract. The article disposes a widely used in former Soviet Union statistic Coefficient of Sample Determination as a criterion for sample homogeneity in social and economic research and its algorithm of calculation in MS-Excel. The geometrical proof of the law of variance decomposition is proposed and the case then it fails is concerned. The liaison between the Coefficient of Sample Determination and Empirical Correlation Ratio is depicted.
Key words: coefficient of sample determination, the law of variance decomposition, MS-Excel, criterion for sample homogeneity, analysis of variance, empirical correlation ratio.

Mahfoodh Bilal Ahmed Mohammed

INTEGRATED DEVELOPMENT ENVIRONMENT FOR THE INFORMATION –CALCULATING APPLICATIONS

Purpose: The paper presents an approach to building specialized object-oriented software tools for the development of so-called information-calculating applications including computer aided accounting, business correspondence, statistics, etc.

Design/methodology/approach: The approach presented here provides a flexible combination of versatility with specialization on the basis of class selection, which brings together many of these specialized information-calculating tasks, and allows the building of an integrated development environment for a set of related applications. This development environment consists of a formula interpreter, a screen form generator and a specialized library of classes.
Findings: This integrated development environment can be applied to a generation of so-called informationcalculating applications used for accountancy, financial analysis, office work, bank operations, statistics, etc.
Research limitations/implications: Present study provides a starting-point for further research in Software Engineering.
Originality/value: Moreover, tools presented here can be useful in improving technique of software development for specialized field of application, in particular for a generation of the different information-calculating applications.
***Key words*:** software tools, interactive systems, information-calculating application.

A.I. Baikov, V.G. Titov

MATHEMATICAL MODEL OF THREE-WINDING TRANSFORMER POWERFUL RECTIFIER FOR SHIP POWER SYSTEM

Purpose: Development of the equivalent circuit is a powerful three-winding unit transformer rectifier ship power system with different detail the processes of magnetization.
Methods: Matrix methods of analysis of electric and magnetic circuits, analytical approximation of magnetization curves.
Finding (Results): The differential equations describing the electromagnetic processes in transformer rectifier with different degree of detail of the processes of magnetization, including taking into account the saturation of the transformer; proposed equivalent circuit, based on the application of the mutual inductance and providing galvanic isolation of the primary and secondary circuits.
Example: The possibility of determining equivalent circuits on the basis of available reference and calculated data, the calculated timing diagram typical load regime.
Application: Analysis of load and emergency regimes rectifier unit ship power system.
***Key words*:** marine energy system, mathematical modelling, transformer, equivalent circuit, magnetization curve, analytical approximation.

S.S. Borodin, A.L. Burov, A.V. Varentsov, A.D. Ershov, A.N. Pronin

EXPERIMENTAL STUDIES IN THE LOCAL HYDRODYNAMICS COOLANT TVSA WITH STIRRING BARS OF "SWEEPING THROUGH THE RANKS" VBER-300

Abstract. Experimental data on the study of the coolant flow hydrodynamics in reactors TVSA WBER-300 with stirring bars of the "sweeping through the ranks." The studies were conducted in the course of flow simulation TVSA on an aerodynamic stand. The aim of the work was to determine the effect of mixing grid "sweeping through the ranks" type on the hydrodynamic characteristics of the flow in the area of the guide channel. The findings revealed the features of the flow of coolant in the guide channel for the stirring bars of the "sweeping through the ranks" in TVSA reactors WBER-300.
***Key words*:** atomic medium power stations, nuclear reactor fuel assembly, mixing grid type "sweeping through the ranks", fluid dynamics, heat transfer.

A. A. Dobrov, K. A. Martynova, Y. A. Fadeeva, A. E. Khrobostov

APPLICATION OF COMPUTATIONAL FLUID DYNAMICS WITH THE PURPOSE OF IMPROVING THE EFFICIENCY OF MIXING GRIDS IN FUEL ASSEMBLIES

Purpose: Numerical simulation of coolant flow in FA with mixing grids and estimation of the various design grids effectiveness based on the obtained data have been carried out in the present study.
Design/methodology/approach: The main characteristics of the mesh properties applied are maximum size of element (0.4 mm), number of elements (8 million) and number of prism layers (20). As boundary conditions inlet flow velocity, temperature of coolant, pressure in the model, the rate of heat transfer have been used. Reynolds stress turbulence model (BSL-RSM) has been chosen as it considers the anisotropy of turbulence.
Results: Application of vanes has led to distortion of temperature profile, at that, there are areas where temperature has increased compared to the spacer grid without mixing vanes. It probably happens due to the local speed reduction of coolant in these areas. The flow resistance coefficient decreases with changing of zero angle of the bending line. The maximum value of Nusselt number corresponds to vanes with the maximum angle of bending, however decreasing of the heat transfer efficiency occurs at shorter distance than at all others. Based to data obtained vanes with construction which allows to minimize both the average temperature and the fuel rod perimeter temperature unevenness have been chosen.
Key words: nuclear reactor, fuel assembly, coolant heat hydrodynamics, spacing grid.

K.I. Kisilenko, M.S. Myakisheva, E.P. Timofeev

DESIGN THREE-CHANNEL SPLITTER IN THE MICROWAVE RANGE

Purpose: Create and measurement three-channel splitter in microwave range.
Design/methodology/approach: The design is based on the divider ring, called the Wilkinson bridge. Simulation and calculation of electrical parameters of the divider was conducted by means of numerical simulation software package.
Originality/value: Simulation device structure in the range 3.15 - 4.05 GHz produced the following results: the input and output VSWR of less than 1.2; isolation between outputs of at least 25 dB; an equal division of power at the outputs of the divider.
Key words: splitter, power divider, ring divider Wilkinson Bridge, the microwave range, LTCC, modeling, CAD, CST Studio, HFSS.

A.I. Kononov

EXPERIENCE OF USING HTML5 ANIMATIONS FOR ORGANIZATION OF INDEPENDENT WORK OF STUDENTS

Abstract. Considered the experience of implementing and testing information and communication technologies in the practice of the teaching of General Physics in the Institute of nuclear energy and technical physics NSTU them. R. E. Alexeyev to address issues of extracurricular organization controlled by the independent work of students, the establishment of a Fund of funds, technology assessment of different types of assessment.
***Key words*:** independent work of students, extracurricular learning, technology assessment.

G.I. Korobko, I.G.Korobko

THE MEASURING DEVICE OF ACTIVE AND REACTIVE POWER AT A VARIOUS FREQUENCY POWER SUPPLY

Purpose: Designing and analysis of the measuring device of currents and power, consumed by load from generator plants with various frequency of rotation.
Design/methodology/approach: Analytical computation and simulation in Matlab Simulink.
Findings: The schematic of the measuring device of active and reactive currents at a various frequency power supply is developed. The device based on passive elements, and it provides high

accuracy of measuring of basic parameters for calculating the power, generated or consumed by sources or consumers.
Originality/value: The device provides high performance and measuring accuracy of parameters in autonomous electrical systems, is simple and reliability. The model of measuring device can be used in designing of control systems of autonomous electric plants and other electric objects.
Key words: generator plant with variable speed of rotation, parallel operation of generators, active power, reactive power, measuring device.

A.B. Loskutov, A.A. Loskutov, D.V. Zyrin

DEVELOPMENT AND RESEARCH OF A FLEXIBLE INTELLIGENT ELECTRICAL GRID OF MEDIUM VOLTAGE, BASED ON A HEXAGONAL STRUCTURE

Purpose: The article is devoted to technologies in the intelligent distribution network which should solve the following problems: improvement of reliability of power supply to consumers; survivability and controllability of systems of power supply, reduction of power losses; increasing the length of the maintenance period between repairs; ; minimization of damage from accidents and shutdowns; increase of energy efficiency and quality of electric energy.
Methodology: Historically, the existing distribution network of medium voltage were not adapted to the big power flow and reconfiguration, depending on the operating mode. Therefore, the construction of energy-efficient intelligent power supply systems in existing radial and trunk topological solutions is not appropriate.
Results: We propose an innovative way to distribute electrical energy for hexagonal-topology defined voltage class and mode of grounding-neutral network. There have been made model experiments of emergency modes were made and new type of relaying network.
Key words: hexagonal network, voltage class, neutral grounding mode, short-circuit current, operating modes, the algorithm of relay protection, Smart Grid.

V.G. Titov, A.I. Baikov, A.I. Balandin, I.A. Batyrev, D.V. Umyarov

ANALYSIS OF ELECTROMAGNETIC PROCESSES IN A RECTIFIER FOR SHIP POWER SYSTEM

Purpose: Development of methods of application of mathematical modeling for analysis of electromagnetic processes in a high-current rectifier for ship power system with a three-winding transformer.
Methods: Matrix methods of analysis of electric and magnetic circuits, analytical approximation of magnetization curves, programming in MATLAB environment.
Finding (Results): Methods of forming and integrating differential equations describing electromagnetic processes in a rectifier, taking into account possible saturation of a transformer are applied; MATLAB interface which allows of simulation by external users is designed.
Example: It is shown how to define input schema of a rectifier of 5400 kVA, typical anomalous modes confirming necessity of considering processes of saturation of a transformer are analysed.
Application: Analysis of electromagnetic processes of a unit converting AC to DC in permanent ship power system.
***Key words*:** ship power system, mathematical modeling, transformer, equivalent circuit, magnetization curve, analytical approximation, MATLAB programming environment.

O.V. Voronkov, V.I. Peskov

COEFFICIENT OF MATERIAL REAL MASS EFFICIENCY AND APPLICATION METHODS

Abstract. On early stage of vehicle body development one of the most relevant tasks is selection of structural materials. For thin-walled parts an important aspect influencing weight and cost

efficiency is availability of only discrete thickness values of material sheets. Forecasting the effect of change from base material to a new one accounting the mentioned aspect is possible using the methods and efficiency coefficients [1, 2] previously developed by the authors. In this paper for evolution of the already existing methods for coefficient of material efficiency and supplementary values new formulas based on probability theory are proposed. The formulas lead to more accurate and reliable forecast and provide its probability characteristics. Also new methods for application of the dependencies are proposed complementing the already existing methods. A distinctive feature of the new methods is possibility to reveal an extended list of materials which can change the base material including those which can fulfill the desired requirements with probability lower than confidence probability.
Key words: material efficiency, discrete thickness of sheets, probability, selection methods, development.

A.V. Zaporozhtsev

TECHNOLOGY DESIGN OF PROGRAM COMPLEX

Purpose: Maintaining the integrity of the individual in the development of software systems comprising of complex software systems. Providing visibility when designing software modules.
Approach: Clarifying the architecture of a software system and a common information model in the design of software systems. The use of screen forms of software modules as the main result the design of software systems. Formalized description of information objects and functions screen forms.
Findings: Stepwise refinement of the architecture of a software system and the common information model allows you to maintain the integrity of the development of complex software systems. The use of screen forms allows to consider the basic requirements of users for each software module.
Research implications: The offered technology of design of software systems can improve the quality of system development through the use of visual representations of design solutions.
Value: The use of visual representations of all elements of the project of the program complex increases the efficiency of software development.
***Key words*:** software system, architecture software system, program complex, software module, screen form, user requirements.

Z.A. Kostrova, A.V. Miheev, M.E. Bushueva, V.V. Belyakov, S.N. Mityakov

THE UTILIZATION OF PNEUMATIC AND AIRLESS TIRES

Abstract. This article describes some reasons for the need of processing and recycling of pneumatic tires, their composition and properties, examples of regulation of recycling in different countries, the calculation of income from the processing of 1 ton of tires, the methods of recovery of tires and the economic effect from using retreaded tires, as well as their consumption in several countries. Described some methods of processing of worn tires, shows an example of semi-automatic processing line of pneumatic tires, as well as the direction of the use of secondary crumb rubber and tires. Also, the design features non-pneumatic (airless) tires and their recycling and disposal. The purpose of this article is to compare the utilization and ways of reusing of non-pneumatic and pneumatic tires.
Key words: pneumatic tire, non-pneumatic (airless) tires, recycling tire, tire recycling, Osborne Reef, dumping of tires, composition of tires, tax and recycling fees, used tires, composition and structure of non-pneumatic (airless) and pneumatic tires, retreading, tire recycling, the economic effect from the use of retreaded tires, semi-automatic line for processing of tires, crumb rubber, polyurethanes.

I.K. Kozlov, A.S. Trofimov

STUDY THE CAUSES OF DEFECTS IN BUTT RESISTANCE WELDING OF ROUND-LINK CHAINS

Purpose: Systematization of major defects in butt resistance welding and development of methods to address them.
Approach: Conducted surveillance during manufacturing of round-link chains and metallographic examinations of the welded joint.
Findings: Major defects in the process of manufacturing of round-link chains have been classified. The most common unacceptable defect is a lack of penetration which in general is caused by low quality billet of a chain and insufficient welding pressure.
Research implications: Developed methods to eliminate causes of the formation of defects in the manufacturing process of round-link chains.
Value: The classification of the major defects, as well as the development of methods for their removal [prevention] would reduce the number of rejects.
Key words: contact butt welding, defect, welded, Round-link chain.

V.S. Makarov, D.V. Zeziulin, A.M. Belyaev, P.O. Beresnev, V.I. Filatov, V.V. Belyakov

CLASSIFICATION OF COASTAL ZONES AS A ROAD TO TRANSPORTAL AND TECHNOLOGICAL VEHICLES AND SYSTEMS

Abstract. The article deals with the necessity of movement of transport and technological vehicles and robotic systems along the coastal zones. Their classification from the standpoint of ground surfaces as the path is shown. The following classification groups of coastlines are identified: in terms of geology, from the point of view of the theory of vehicles movement, in terms of size of the water body, in terms of soil type, in terms of presence of vegetation, in terms of when driving during the winter, in terms of presence and size of the cross-slope, in terms of constancy of movement characteristics, in terms of humidity changing and the proximity to the water, in terms of formation.
***Key words*:** coastal zone, classification, autonomous mobile robot.

Nguyen Ngoc Tan

THE INCLINATION OF THE WATER REPLACEMENT VESSEL UNDER A LIST IN LONGITUDINAL ROUGH SEA

Purpose: Research of the movement of the water replacement vessel under a list in longitudinal rough sea.
Method: When the list is affecting the vessel moving longitudinally in rough sea. Changes in list & trim difference occur. The movement of the vessel is descended in the method “dynamics” of the system of equations. The calculation was made in numerical Runge-Kutta R-R 4 order with the help of IBM PC.
Results: The calculation show that the angle of the list of the vessel in longitudinal rough sea depends on the speed of the vessel, cause angle on the rough sea and the meaning of the applied list up moment. The maximum value of the angle of list depends not only on the dynamic heeling moment, but also on the parametric resonance.
Conclusions: The results, obtained in this study, allowed to evaluate the transverse ship stability on longitudinal waves. Under the influence of dynamic loads on the length of a small vessel the calculation of ship stability can not be made on the instant chart of stability. According to the results of calculation, the crew can select the speed, the target angle on the wave to reduce the risk of capsizing and swapping.
Key words: the heeling moment, stability, list, trim, dynamic load.

N.M. Tudakova, V.V. Kraynov

DORN FOR SURFACE PLASTIC DEFORMATION INTERNAL SURFACES

Purpose: Shows the new design and theoretical studies of the formation of the hardened surface layer of the internal cylindrical surfaces.
Design/methodology/approach: Implementation of translational return movement of the processing tool, eliminates the probability of rupture of the lubricating layer in the contact area of the tool to the workpiece, reduce friction, friction work and energy costs of lubrication process.
Findings: The application of this technical solution improves the lubrication conditions at the expense of translational return movement of rigidly fixed-deforming progressively return the ring and freely set by deforming and progressive ring plate Z-shaped spring.
Originalitu/value: Reciprocating internal burnishing holes.
Key words: quality, hole, mandrel, hardening.

V.Y. Shurygin, L.N. Orlov, A.S. Vashurin

EXPERIMENTAL RESEARCH OF STIFFNESS OF LIGHT COMMERCIAL VEHICLE CAB SUPPORT

Purpose: Determination of stiffness of light commercial vehicle cab support for further using in finite element analysis of robustness of bearing structure.
Design/methodology/approach: The experimental study made on tensile-testing machine with using of special devices and equipment of Center of collective using “Transport systems”.
Findings: The results obtained during the experiment allow estimate the vertical and horizontal stiffness of light commercial vehicle cab support.
Research limitations/implications: The present study provides a starting-point for further research of robustness of light commercial vehicle bearing structure taking in account mechanical characteristics of a frame, cab, platform and all rubber-metal elements including cab and platform supports.
Originality/value: The main feature of the study is using of modern measurement equipment and analytical approach that could be used for determination of vehicles fuel consumption.
Key words: test, rubber-metal element, stiffness.

M. E. Frantsev, O. V. Zaytsev, I. D. Zolotarenko

THE MODEL OF THE PROJECT’S ENSURING OF THE STRENGTH OF THE SUPERSTRUCTURE FROM COMPOSITES FOR A PESSENGER HYDROFOIL CRAFT IS USING THE NUMERICAL METHODS

Abstract. The design of the superstructure made of polymer composite materials for passenger hydrofoils, is a part of the design of vessel. The superstructure enters to subsystem “hull” as a subsystem. Design optimization of superstructure from composites is directly related to the optimization of the entire vessel. The subsystem "Hydrodynamic complex", including contours immersed part of the body with a part of the freeboard actually underwater wings with racks and propulsion to support the propeller shaft, which is under the hull and rudders located behind the aft wing in the design of the superstructure considered as a finished module applied from the project 17091 passenger SEC "Polesie". The criterion of economic efficiency of the hydrofoil craft is the condition to minimize fuel consumption on the movement of 1 dwt (payload) at 1 km. Minimization of empty displacement of the passenger hydrofoil craft is provided by ensuring minimization of the mass of the body (which includes and superstructure) ceteris paribus other articles weighing load characteristics of the need to ensure its durability. The model of the project to ensure the strength of the superstructure of the composites for passenger hydrofoil craft is using numerical methods includes the following steps: determination of external loads of the total bending decomposition subsystem "hull”, the definition of the original matrix and reinforcing phase for composites and

schemes of reinforcement and technology of the superstructure materials and schemes and methods of fixing, fixings superstructure, the development of a constructive force scheme and the mutual arrangement of the elements of the superstructure from composites for hydrofoil craft, development of 3D-model of the superstructure from composites by numerical methods, testing the strength of the superstructure elements from composite design and optimization. When analyzing the results of calculations made by it can be seen that the strength of the superstructure is provided in all cases the settlement.
Key words: design model, the strength of the hydrofoil craft, superstructure from composites, external loads, the overall bending, numerical methods.