Requirements to concrete products surface

L.A. Mamaev[a], V.S. Fedorov[b], S.N. Gerasimov[c], R.M. Farzaliev[d]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]pro_uch@brstu.ru, [b]fedorov-v-s@yandex.ru, [c]sdm_gerasimov@rambler.ru, [d]farzaliev-R-M@mail.ru
Received 10.06.2013, accepted 10.08.2013

Concrete products must possess high accuracy of geometrics observance, surface finish and evenness, sufficient adhesion for finishing materials covering, crack resistance. Besides, ferroconcrete constructions are used in adverse service conditions that, in turn, influence the durability of constructions produced of such items. Even small asperities or cavities, being filled with water, can become the coating damage centers. Due to the temperature difference, water leaking from the deep layers to the surface increases the extent of the surface layers water saturation and results in their damage. Rapid and complete water drainage from concrete surfaces due to the reduction in surface layer roughness is one of the major factors providing durability of the facade building elements, road and airfield pavements. Besides, ferroconcrete products must possess crack resistance during their transporting and operation. In the Russian Federation, the requirements to the concrete products quality are regulated by the appropriate State Standards, specifications (TU) and the Construction Norms and Regulations. The review of normative documents on ferroconcrete structures and products used in various construction areas has demonstrated that the surface finish issues are of great importance.

Keywords: roughness, surface, float finish, durability, product, strength, forming, construction.

Ultrasonic device for surface treatment of natural and artificial stone equipped with dynamic damper

L.A. Mamaev[a], V.B. Kashuba[b], M.V. Berezhnoy[c], P.A. Wojciechowski[d]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]pro_uch@brstu.ru, [b]plemja@rambler.ru, [c]mikhail.28.10.90@mail.ru, [d]pashavs@bk.ru
Received 12.06.2013, accepted 20.08.2013

The article points out the advantages of ultrasonic technology for processing hard and brittle materials (high quality of the machined surface, production universality and safety). A number of its serious drawbacks such as a significant performance decrease due to the increase in processing depth, small contact area of the tool with the working surface, high power-intensity of the process and low equipment efficiency are highlighted as well. It also provides an overview and analysis of the existing ultrasonic devices for the surface treatment of natural and artificial stone equipped with the dynamic damper. To overcome the above-mentioned drawbacks while maintaining the operational principle of the existing ultrasound devices, a new design to process the natural and artificial stone surface equipped with a dynamic damper, which allows improving the performance of the treatment process due to the three operating devices. They are symmetrically arranged in a circumferential direction to form a tandem (rocker bars) set transversely to the cross bar and elastically connected to the outer damper of the induced vibrodisturbance. It provides guaranteed vibrations damping in a wide range of low-frequency spectrum, thereby ensuring the high quality surface treatment of the products made of artificial and natural stone, brittle and hard-to-machine materials. Besides, the speed and quality of processing are influenced by cavitation and abrasive slurry flows that increase the abrasive grains circulation contributing to the replacement of the spent grains by the new ones and the removal of the damaged material particles through the spent suspension discharge tube.

Keywords: ultrasound device, damping, surface treatment.

Assessment of bulldozers operation reliability

V.N. Anferov[1, a], S. M. Kuznetsov[1, b], S.I. Vasil'yev[2, c]

[1]Siberian Transport University, 191 D. Koval'chuk st., Novosibirsk, Russia
[2]Siberian Federal University, 82 Svobodny av., Krasnoyarsk, Russia
[a]avn43@mail.ru, [b]ksm56@yandex.ru, [c]S-vasilev1@yandex.ru
Received 15.06.2013, accepted 16.08.2013

The authors have proposed a model to assess the bulldozers operation reliability. By means of this model, it is possible to estimate the operation efficiency and reliability of bulldozers and other building machinery on any project. This will allow

predicting most reliably the periods of work execution and their cost at the construction design stage. In the article, the indicators of technical-organizational and operational reliability have been determined and the reliability assessment to perform construction and assembly works has been given. To assess the reliability of transport and operating process, the authors of the article have proposed the concept of reliability as a hitting probability for a set of machines and mechanisms to achieve an ultimate goal when implementing project works. One of the major factors of building machinery operation reliability is the timed operation factor during working shifts or a year. This coefficient value requires permanent monitoring because the process of the building machinery technological improvement occurs on the basis of the experience accumulated in the process of their employment. This is common with the majority of machine types such as excavators, bulldozers, pipe-layers, hoisting cranes and others. The proof of the database values validity was carried out according to the results of in-situ testing during the two-stage inspection – logical and mathematical. The produced sampling was checked for its compliance with the distribution law. Then the reliability to finish the amount of earthwork in the stipulated period of time was assessed. The authors considered three types of the coefficients for the timed machine utilization: technical failure; organizational reliability and organizational-operational reliability of bulldozers' works performance. This approach allowed forcasting to a high precision the work completion time. The use of the proposed approach to assess the bulldozers operation reliability can be applied to any type of equipment and will allow obtaining the numerical values of the reliability assessment that is of great current interest when choosing not only the type of equipment, but its high-speed and cargo-carrying characteristics as well.

Keywords: organizational and technological reliability, organizational and technological risk, building machinery.

Basic principles of methods for calculating electromagnetic exciters used in a mixing unit

I.M. Yefremov[1, a], V.A. Kuz'michev[2, b]

[1]Bratsk State University, 40 Makarenko st., Bratsk, Russia
[2]Saint-Petersburg State Polytechnical University, 29 Politekhnitcheskaya st., St.-Petersburg, Russia
[a]sdm@brstu.ru, [b]kuzmichev_va@mail.ru
Received 15.05.2013, accepted 15.08.2013

The implementation of the vibratory mixing mode, which gives obvious possibilities in the field of both obtaining high quality materials and the development of high-performance units, do not get any practical application. One of the reasons for this is the lack of reliable designs and modern techniques to calculate the optimal parameters. To eliminate the indicated problems, it has been proposed to use shell elements in the form of sylphons and composite structures as vibration activators. To create the vibration field, the electromagnetic exciters notable for their reliability, low power consumption and small dimensions have been used. In addition, the authors have proposed a technique to calculate the main parameters of the exciters based on the vibration theory. The mathematical dependences given in the article are the result of in-depth theoretical and experimental research and determine the optimal parameters when choosing the operating modes of the unit and its geometrical and kinematic parameters. The comparison of the calculation results of the vibratory exciter's main parameters revealed in the paper are indicative of the acceptability of the obtained expressions for engineering calculations while introducing the electromagnetic exciters as a drive for vibratory exciters in the forced mixing units that allows eliminating the time-consuming finite-element simulation.

Keywords: electromagnetic vibratory exciters, shell vibration activators, vibration theory.

Assessment of hydrotransport systems reliable performance

V.B. Permyakov[1, a], V. N. Anferov[2, b], S. M. Kuznetsov[2, c], S.I. Vasil'yev[3, d]

[1]Siberian Automobile and Road Academy, 5 Mira st., Omsk, Russia
[2]Siberian Transport University, 191 D. Koval'chuk st., Novosibirsk, Russia
[3]Siberian Federal University, 82 Svobodny av., Krasnoyarsk, Russia
[a]kaf_edm@sibadi.org, [b]avn43@mail.ru, [c]ksm56@yandex.ru, [d]S-vasilev1@yandex.ru
Received 12.04.2013, accepted 15.08.2013

The authors have proposed the model to assess the hydrotransport systems reliable performance. By means of this model, one can assess the performance efficiency and reliability of hydrotransport systems and other construction machines employed at any project. It will allow predicting most precisely the terms to perform certain types of works and their cost as early as at the design stage. In the article, such complex reliability indicators as the factors for availability, operational availability, percentage of uptime and efficiency retention have been determined. To assess the reliability of the transport and operational procedure, the concept of reliability as a hitting probability to achieve the ultimate goal while performing installation and construction works by a group of machines and mechanisms has been proposed. One of the major reliability factors of the construction machines performance is their time utilization rate. All the regulations provide outdated (25 - year old) data on the machine utilization efficiency during work hours, which need to be updated as the machines are constantly being modernized. To assess the performance reliability of construction machines, the database of full-scale test results for dredges, cranes, excavators, bulldozers and pipe-layers has been developed. To substantiate the database, the two-stage inspections based on the full-scale test results were carried out: the logical and mathematical ones. On sampling according to the State Standard (GOST) 8.207-76,

its compliance with the normal distribution law was checked by means of Pearson best-fit criterion. Then, the reliability and risk of the planned earthwork volume completion by the hydrotransport systems for the planned time interval were calculated.

Keywords: hydrotransport system, reliability, model, complex indicators, availability factor, *operational availability factor, percentage of uptime, efficiency retention factor,* organizational and technological reliability, organizational and technological risk.

Providing minimum amplitude of natural oscillations of elastic systems under prompt pulse action

Nguyen Phu Tuan[a], V.I. Sobolev[b]

National Research Irkutsk State Technical University, 83 Lermontov st., Irkutsk, Russia
[a]bennaydaiduong@yahoo.com, [b]vladsobol@yandex.ru
Received 21.05.2013, accepted 20.08.2013

The finite-dimensional dynamic models based on different principles of discrete approximations are currently the most popular in the research and design of the systems for various applications. The solving of the problems related to the definition and formation of the natural oscillations parameters of such dynamical systems is associated with the eigensolution problem, which allows implementing the separation of differential equations of the original multiply model dynamics in some cases. The possibility of such a multiply model separation of the equations original system into individual differential equations has been used in this paper to form the dynamic systems with desired properties under prompt pulse action. The presentation of the original dynamical system in the space of eigenvectors determined by the eigensolution problem allows using the results obtained under the pulse influence on the one-dimensional oscillating system. Conversion of analytical expressions describing one-dimensional system oscillations under the pulse inputs (inverse transformation from the eigenvectors space into the original one) allows determining the conditions to form the systems with specified properties. In this paper, we produce the solution of the problem of the second order system formation having the minimum amplitude of natural oscillations in a given direction and mismatching the pulse action direction.

Keywords: elastic-dynamic systems oscillations, prompt pulse, eigenvectors matrices, natural frequency, eigenvalues, amplitudes.

Algorithm for calculating rational geometric dimensions of shell-plate valve seat without regard to working pressure

A.M. Dolotov[a], Yu.I. Belogolov[b]

Irkutsk State University of Railway Engineering, 15 Chernyshevsky st., Irkutsk, Russia
[a]amdolotov@mail.ru, [b]pr-mech@mail.ru
Received 20.05.2013, accepted 21.08.2013

An algorithm for calculating rational geometric dimensions of a thin-walled valve seat without regard to the working pressure (sealed) medium has been considered. A thin-walled shell-plate-shaped saddle has been selected for the research object as the most technologically advanced. The algorithm is executed in accordance with the State Standard (GOST) 19.003-80 and is represented as a flowchart describing the consecutive setting, defining and calculating the shell-plate valve seat parameters. For each block of the algorithm, there is an explanation comment that describes the set or defined parameters. Conventionally, the algorithm is divided into three main parts: the stiffness parameters definition, the determination of strength parameters and calculation of the seat rational geometric dimensions. The calculation of the rational geometric dimensions of a shell-plate saddle is conducted without pre-determining the maximum dynamic impact stress using the MathCAD built-in functions and the Given – Minimize block. The reduced stiffness of the valve seat is taken as a minimand. The check to monitor the compliance with the specified conditions concerning the allowable stress in the source data is conducted after carrying out the calculations in the Given – Minimize block and obtaining their results. In case of failing to fulfil the allowable stress conditions, the recalculation should be done, specifying the initial approximation values for the plate and shell seat which are then transferred to the Given – Minimize block. After calculating the output values for the shell and plate thickness, the stress charts for the shell-plate seat can be constructed.

Keywords: algorithm, shell-plate seat, stiffness, thin-walled structures stress calculation, valve stressing dynamics, optimization.

Analysis of cargo shifting in the process of car's moving along the straight track section

V.A. Olentsevich[a], V.E. Gozbenko[b]

Irkutsk State University of Railway Engineering, 15 Chernyshevsky st., Irkutsk, Russia
[a]olencevich_va@irgups.ru, [b] vgozbenko@yandex.ru
Received 4.05.2013, accepted 8.08.2013

Ensuring safe operation under the railroad transport reform remains one of the most important strategic tasks of JSC "Russian Railways" and its solution has been defined as the absolute priority in the development strategy of railroad transport through to 2030. In this regard, the paper reflects the urgency of improving the existing calculation procedure of securing cargo transported on an open rolling-stock that will provide the basis to improve the railroad transport system safety. Traffic safety is assessed by the criterion of shifting the cargo equipped with freight loops about the carriage by constructing the mathematical and dynamic models for securing cargo placed both along and across the car. The general case when the cargo shift occurs along the resultant spatial system of forces has been considered, the angle characterizing the cargo shift in the deck plane has been calculated. The calculations were carried out in the PTC MathCAD batch. The initial baricentric geometric parameters are taken for a standard platform and cargo. The curve characterizing the cargo shift along the resultant force has been constructed and the shifts obtained in doing so both longitudinally and transversely depending on the force inclination angle relative to the longitudinal axis have been produced as well. The calculation results have revealed that the behavior of the cargo shift is nonlinear. Under the given initial data and the adopted technology of securing cargo in the car, there is a certain probability of breaking some fixtures. In this regard, there is a need to introduce some changes in the geometry of securing cargo.

Keywords: cargo shift, traffic safety, dynamic and mathematical models, stretch marks response, securing of cargo in the car.

Experimental research of self-adjusting double-acting hydraulic damping device

Nguyen Manh Duc[a], N.K. Kuznetsov[b]

National Research Irkutsk State Technical University, 83 Lermontov st., Irkutsk, Russia
[a]Duchien19811989angs@gmail.com, [b]knik@istu.edu
Received 16.05.2013, accepted 2.08.2013

Providing high speed and accuracy of the actuators positioning under the conditions of changing masses and motion speed is an urgent problem for developing mechatronic systems with interlocking systems. At present, it is solved by developing hydraulic damping devices, which provide speed reduction prior the positioning. The disadvantage of the existing devices is the necessity for manual adjustment according to the changes in loads and motion speed and providing just one-way braking. The effective means of solving this problem is to use a self-adjusting double action hydraulic dampers offering bootstrapping under the conditions of changing masses and motion speed of the actuators and providing braking in both directions. The article presents the results of experimental research of the experimental model of a self-adjusting double-acting hydraulic damping device to use it in the industrial robot MP-9S. The choice of modern measuring equipment, the experimental apparatus description, the research procedure and the results analysis are given in the article. The experimental studies have confirmed the results of theoretical calculations and demonstrated performance and high efficiency of the proposed damping device. At the same time, the use of the proposed damping devices will improve the dynamic accuracy, operation speed and reliability of these mechatronic systems.

Keywords: hydraulic damper model, experimental technique, experimental studies results.

The radius distribution influence of the rough surfaces asperities on contact characteristics

P.M. Ogar[a], D.B. Gorokhov[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]ogar@brstu.ru, [b]denis_gorohov@mail.ru
Received 4.05.2013, accepted 14.08.2013

The approaches in developing a rough surface discrete model describing the bearing profile curve by a parabola or by the ratio of incomplete beta function are considered. The rough surface is represented as a set of spherical segments with constant or variable radii. The location of a separate asperity is determined by the apexes level u and the bays level v. The distribution of asperities apexes and bays is described by a two-dimensional function $\varphi_n(u,v)$. The functions and density distribution of the asperities with height are determined from the equation for the bearing profile curve. The comparative analysis of these functions has been carried out. A system of equations to determine the relative area under the elastic contact with rough surfaces are given. To estimate the contact loading, a force non-dimensional elastic-geometric parameter $F_q = q_c\Theta/R_{max}$, has been used, where qc is a contour contact pressure, $\Theta = (1-\mu^2)/E$ is an elastic constant, ac, R_{max} are the microgeometry parameters. The necessity to take into consideration the mutual influence of asperities for Fq >0,1 in case of using low-modulus materials has been stated. The influence of the radius asperities distribution on the calculations results of the relative contact area has been shown. To obtain the exact calculations of the contact characteristics, it is recommended to use the rough surface discrete model, which takes into account the asperities height distribution.

Keywords: rough surface, asperity parameters, bearing profile curve, bearing curve parameters, beta function, distribution of asperities apexes, distribution of asperities bays, contact characteristics, relative contact area.

On the issue of forming the structure of the baseline models of vibration protection systems

V.B Kashuba[a], E.A.Parshuta[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]plemja@rambler.ru, [b]parshuta@mail.ru
Received 2.06.2013, accepted 19.08.2013

Some issues of forming the structure for the baseline design models of vibration protection systems are considered. The possibilities of the standard elements spatial arrangement are taken into consideration. It has been shown that the models which reflect the capabilities of rectilinear translation and the ones with rotational movement of a protection object have vital difference. The analogy of the two different types of movement exists, but the correspondence adequacy requires additional substantiation. It has been demonstrated that the rotational type systems have the property of forming the system spatial metrics provided by the lever constraints being the characteristics of this type of movement. The characteristic feature of the system being the presence of a weightless hard rod or lever with spatial dimensions, a significant importance takes on the coordinates of the standard elements pinning points. The issues of reducibility for the systems of one type to another (translational to rotary motion and vice-versa), which require to be careful with the systems features connected with the lever constraints manifestations inherent in this type of movement are considered. The methodological foundation to search and develop new structurally engineering solutions for the problems of vibration protection is proposed.

Keywords: vibration protection systems, mathematical models, lever constraints, transfer functions of vibration protection systems.

Evaluation of the required force impact on high parameters to ensure the valves sealability

V.K. Pogodin[1, 2, a], N.A. Verkhozin[1, b], P.M. Ogar[2, c], V.A. Tarasov[2, d]

[1]JSC Irkutsk Research and Design Institute of Chemical and Petrochemical Engineering, 3 Academician Kurchatov st., Irkutsk, Russia
[2]Bratsk State University, 40 Makarenko st., Bratsk, Russia

[a]vkpogodin@yandex.ru, [b]verhozin@himmash.irk.ru , [c]ogar@brstu.ru, [d]tv-post@yandex.ru
Received 14.05.2013, accepted 2.08.2013

The results of experimental research into the high-pressure equipment valves sealability have been produced. The research objective was to compare the obtained results and the design values of sealing pressure provided by the normative documents. It has been stated that all the experimental joints loaded with the design sealing force N have some leakage that exceeds the permissible one. The flat-type sealing joints are characterized by reduction of the microasperity height at the contact area. The microrelief change for the cone-type sealing joints takes place in two stages: at first, the height of microasperities goes down and then, due to the sliding motion under the action of loads and seizure, the scorings are formed that results in the increase of the microasperities height. It has been demonstrated that to ensure the designated sealability, it is necessary to increase sealing pressure. Therefore, there is need to specify the "sealing pressure-leakage" rated dependences.

Keywords: valve, sealing joint, sealability, leakage, sealing pressure, high pressure.

Design, calculation and test results of the wheeled running gear for slow moving vehicles

S.P. Rykov[a], A.V. Snitsarev, S.N. Teterin

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]RSP7-8-48@rambler.ru
Received 25.07.2013, accepted 15.08.2013

One of the possible trends in solving the problem of tires disposal is the re-use of the taken out of service defective automobile and other types of tires through the development of elastic polymeric elements mounted inside the tires and acting as compressed air. It is naturally that the wheels developed on the basis of sub-standard tires with discretely located elastic elements can only be used for slow moving vehicles where wheel unbalance, increased rolling resistance and unevenness of the tires elastic properties are not so important for the dynamic loading and fuel efficiency of the vehicle. A new wheel design, which allows changing its rigidity in the process of operation by adjusting the elastic elements position, has been developed. The rectangular in cross-section non-closed rings have been selected as elastic elements. They and made from elastic polyurethane, uniformly placed along the tire's perimeter and fixed on the rim with the possibility of branching at a given angle relative to each other. Based on the calculations, the elastic elements (rings) have been made, their cross-sections being 30x40 mm, external diameter being 180 mm and 24 pieces in number. The rings were installed in the 90% worn Dunlop 235/75 R15 tire. The analysis of the processing results of rigidity characteristics has demonstrated that the wheel has sufficient load-bearing capacity, and the force heterogeneity along the perimeter of the wheel does not exceed 9%. Accordingly, the wheel absorptive capacity (inelastic deformation resistance of tires with elastic elements) decreases by about the same amount.

Keywords: tires disposal, wheeled running gear, elastic element, calculation, experiment.

Transport system management under the conditions of passengers' choice between two types of public transport

M.E. Koryagin

Kemerovo State Agricultural Institute, 5 Markovtseva st., Kemerovo, Russia
markkoryagin@yandex.ru
Received10.06.2013, accepted 9.08.2013

The system of the urban passenger transport management has been considered under the conditions when there are two subsystems different in tariff, traffic interval and travel time. A passenger's utility function involving the choice of the urban passenger transport subsystem has been constructed. Passenger traffic is represented as a set of spare time cost movements distributed exponentially. The function of the passenger traffic inputs has been constructed. It is depended on the tariffs, traffic intensity as well as the probability of selecting one of the two urban passenger transport subsystems. The variable for the passenger traffic is the probability of selecting a passenger transport subsystem. The convexity of the passengers inputs function with respect to the variable has been proved. Urban passenger transport is presented by a great number of transport companies, each of them running a set of routes. Some of the passenger traffic flows can be served by several routes and, therefore, a conflict of interest among transport operators occurs. After the distribution of passengers between the urban passenger transport subsystems, the mathematical model of the passengers' distribution among the routes of each public transport subsystem has been constructed. The model is based on the selection of the first vehicle approached a stopping point that allows transporting to the destination. The coalition-free game of transport companies that aim at maximizing their profit and passenger traffic trying to minimize their travel costs has been constructed. The existence of Nash equilibrium has been proved.

Keywords: ***urban passenger transport***, transport companies, spare time cost, game theory, Nash equilibrium.

Methodology for formation of identification algorithm and diagnosis of analog industrial facilities

V.V. Luzgin[a], A.D. Ul'yanov[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]Uts@brstu.ru, [b]Coberul@gmail.com
Received 23.04.2013, accepted 21.08.2013

The article presents the definitions of the system analysis of diagnostic information and information dense object. The goals, objectives and stages of the analysis are given in detail. The applied algorithm for diagnosing electrothermal objects is considered. The necessary and sufficient conditions for the object's mathematical model are determined (the unity of these conditions is always in conflict). The conditions to determine the structural parameters on the basis of ratio calculation of the known type of differential equations by the output process and solution of nonlinear algebraic systems have been produced, and their equations express the dependencies of the differential equations coefficients on the structural parameters characteristic. Classical algorithm for recovering the homogeneous linear differential equation under the non-zero initial conditions is examined. The practical application of the method to determine the differential equation coefficients by the example of the dynamics of the transformer of a high-voltage pulse ignition system has been demonstrated. The general solution of the fourth order differential equation describing the dynamics of the transformer of a high-voltage pulse ignition system, vertical free motion of a car suspension, the servo drive of other software have been considered. The major shortcomings of the general solution that impede its practical realization have been determined. It has been established that if the output process is the algebraic sum of partial solutions and their total forms a fundamental system, then at a certain type of the differential equation one can determine the coefficients of this differential equation. The factors having effect on the inaccuracy of determining the differential equations coefficients are determined.

Keywords: system analysis of diagnostic information, object mathematical model, primary identification of software dynamics, secondary identification of software dynamics, differential equation coefficients, dynamics of a transformer of a high-voltage pulse ignition system, inaccuracy of determining differential equations coefficients.

Solvability of a nonlinear functional differential equation of the first order with aftereffect and its applications

A.S. Larionov[a], I.A. Nikishina[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a] larios84@yandex.ru, [b] ipa_Q@mail.ru
Received 19.05.2013, accepted 12.08.2013

In this paper, a nonlinear functional differential equation of the first order with a locally defined operator (Nemytsky's operator) on the right-hand side is considered. Generally speaking, the operator doesn't possess the property of monotonicity. The sufficient solvability conditions at some cone segment of the boundary value problem and the Cauchy's problem are proposed. The proof of the theorems on the existence (and uniqueness) of the nonlinear problems solution is based on the reduction of the initial differential equation to an equivalent, in some sense, Hammerstein's integral equation with a monotone completely continuous operator. For such equations, the statement of solvability and the existence of the solutions ordered pair is true. The reduction to the equation with a monotone operator is possible if Green's function of some auxiliary linear problem (Cauchy's function of the corresponding linear functional differential equation) retains its sign. The results obtained in the first part of the paper are used for the research of dynamic processes in Economics, Biology, Pedagogics. In particular, the dynamics of the basic production assets of an enterprise taking into account the delay in the process of capital investment is studied. At the same time, it is assumed that the nature of the investment flow is nonlinear. The nonlinear problem from the field of population dynamics taking into consideration time delay (the model of Hutchinson-Wright) is investigated as well. The sufficient conditions for the existence of bounded solutions of a functional differential model are given.

Keywords: functional differential equation, mathematical model, monotone operator, Economics, Biology.

Features of tail recursion transformation in a functional dataflow language for parallel programming

V.S. Vasil'yev[a], A.I. Legalov[b], A.I. Postnikov[c]

Siberian Federal University, 82 Svobodny av., Krasnoyarsk, Russia
[a]rrrFer@mail.ru, [b]legalov@mail.ru, [c]alpost@mail.ru

Received **17.05.2013, accepted 21.08.2013**

The paper deals with detection of a tail recursion and its transformation into the cycle for the PIFAGOR functional dataflow parallel programming language. The language is focused on the implementation of not only consistent calls but parallel recursive ones as well. At the same time, the use of the tail recursion is also acceptable and allows implementing pipelined parallelism while using asynchronous lists. Among the choices, the case where a recursive call is the last operation within the delayed list disclosed before returning from the function is studied. It is assumed that an argument entering the function is a data list or a scalar. This situation is one of the simplest and it is being widely used in various programs. The implementation of the method of its transformation into iteration allows further programs optimization where the tail recursion is combined with other operations used in a functional dataflow parallel programming. The examined example shows the features of replacing the tail recursion by a special repetition operation, which allows redirecting the output dataflow used for entering the function argument toward the input. For the case under consideration, the algorithm of the tail recursion transformation into iteration has been proposed. The actions made by the function loop statement in transferring the data to the argument input have been described. The performed transformations are carried out on a reversing information graph being formed in the process of translation of the analyzed function incoming texts.

Keywords: tail recursion, code optimization, functional programming, dataflow programming, information graph, destructive assignment, delayed list.

Algorithm for partition polinomials analytical derivation

V.A. Mel'nikova

Irkutsk State University, Bratsk Branch, 34 Lenin st., Bratsk, Russia
Vera_smart@rambler.ru

Received **16.05.2013,** accepted **26.08.2013**

Combinatorial partition polynomials are widely used for combinatorial sums conversion and discrete distribution modeling. Bell and Platonov's polynomials belong to this class. In literature, there are some expressions, which can be used for partition polynomials construction. However, the problem of developing special software designed for the computer-assisted partition polynomials construction has been of current interest so far. In this article, a special algorithm to solve the problem of developing the partition polynomials analytical derivation has been presented. The developed algorithm is designed to prepare the partition polynomials to be used in recurrence relationships in the process of polynomials matrix construction. The algorithm is included in the special program complex aimed at the computer-assisted partition polynomials construction and the discrete renewal processes parameters based on these polynomials are calculated. The structure and main program methods dispatch of the algorithmic complex have been considered in other author's articles. Besides, the block diagram has been presented and some aspects of its software implementation in Nokia Qt Creator have been revealed. The description of the structure for storing polynomials parameters in RAM is given and the recurrence relationships for partition polynomial construction are considered. In the final part of the article, the results of the developed software performance evaluation have been demonstrated.

Keywords: combinatorial partition polynomial, specification, analytical derivation algorithm.

Problems of power transformers operation reliability

A.V. Khlystikov [a], I.V. Ignat'yev[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]al@stemi.ru, [b]uts@brstu.ru
Received 6.05.2013, accepted 19.08.2013

The theoretical researches making up a scientific basis for an integrated approach to the problem of increase of the power transformers operation reliability and allowing broadening the ideas of the operation problems for the existing power transformers park have been considered and analyzed. The standard manuals regulating power transformers operation in Russia have been analyzed. The processes resulting in failure development of the power transformers in operation as well as the

methods of their control and decision-making criteria concerning the possibility and expediency of power transformers further operation have been considered. It has been demonstrated that the research into the problems of power transformers operation reliability is of important economic value aimed at the increase of operation reliability of the power transformers park operated at Russia's electric networks power plants and substations. It has also been noted that to obtain some practical effect, it is necessary to conduct a complex of theoretical and pilot studies as well as to develop the methods and criteria.

Keywords: power transformers, operation reliability, service life, operation problems, damageability, assessment of technical condition.

Digital flickermeter adaptation to assess the fliker dose of alternative light sources

K.E. Lisitsky[a], A.V. Strumelyak[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]crafty05@mail.ru, [b]volandis@mail.ru
Received 13.04.2013, accepted 28.08.2013

In modern power quality analyzers, the technique for the flicker dose assessment is based on the light fluctuations studies of 60 W incandescent lamps as a standard light source. In turn, for fluorescent, LED and other alternative light sources widespread nowadays, the use of this technique without correction for the light source type results in a more systematic error in estimating the flicker dose in the general purpose electric networks. It occurs due to the fundamental difference in the normative frequency response of the alternative light sources flicker from the traditional normative frequency response of 60 W incandescent lamps flicker. In the paper, the problem of reducing the systematic error in the operating standards while determining the light sources flicker dose alternative to 60 W incandescent lamps is emphasized. According to the operating standards, the assessment of the flicker dose caused by any kind of voltage fluctuations in the general purpose electric network can be done by direct measurement using power quality analyzers having a function of a flickermeter, its standard model having no correction for the light source type. In addition, at the present there are no formal approaches to implement such a correction. To solve the above-mentioned problem, the paper proposes a method to improve a standard model of a flickermeter by introducing the additional block of correction for the light source type.

Keywords: flicker, flicker dose, light source, continuity studio.

Electrodiamond machining of high-strength materials with applying protective finish

A.S. Yanyushkin[1, a], V.Yu. Popov[1, b], O.I. Medvedeva[1, c], S.V. Kovalevsky[2, d], D.A. Rychkov[1, e]

[1]Bratsk State University, 40 Makarenko st., Bratsk, Russia
[2]Donbass State Engineering Academy, 72 Shkadinova st., Kramatorsk, Ukraine
[a]yanyushkin@brstu.ru, [b]berkutoff@rambler.ru, [c]mokgluvas@mail.ru, [d]jane.mishura@inbox.ru, [e]dielektrik84@mail.ru
Received 14.05.2013, accepted 24.08.2013

The issues of practical application of the combined electrodiamond grinding are examined in the article. The essence of this method lies in the fact that the electrodiamond grinding scheme is connected with the additional reverse polarity circuit. In this case, there is a continuous electrochemical trimming of the wheel along with dissolution and mechanical removal of the material. Under these conditions, the metal-bonded wheels operate in the self-sharpening mode with a minimum flow rate. Enhancement of technological capabilities of grinding equipment and efficient combined electrodiamond machining of high-strength materials are practicable due to the electrochemical deposition of anti-friction and anticorrosive films on the surfaces of the diamond wheel and the workpiece to be processed. Under these conditions, the process of cutting becomes easier and results in increasing productivity and quality of the machined parts surfaces. The technique's application provides the diamond wheels grinding in the self-sharpening mode and ensures the constancy of its geometric form, which leads to the defective layer absence on the machined surface and increases the cutting power period.

Keywords: electrodiamond machining, high-strength materials, diamond wheels, passivating film.

Research into the influence of magnetic-pulse processing technique on cutting tools reliability for heavy-duty lathes

A.Yu. Andronov[1, a], A.S. Yanyushkin[2, b], D.V. Lobanov[2, c], D.A. Rychkov[2, d]

[1]Donbass State Engineering Academy, 72 Shkadinova st., Kramatorsk, Ukrane
[2]Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]aandronov@list.ru, [b]yanyushkin@brstu.ru, [c]mf_nauka@brstu.ru, [d]dielektrik84@mail.ru
Received 16.05.2013, accepted 28.08.2013

The results of the research into the pulse magnetic field influence on the reliability of tools for heavy-duty lathes have been considered. The investigation of the sample plates surface microhardness before and after magnetic-pulse processing has been conducted. It has been revealed that microhardness of the plates made from T5K10 hard alloy increases after it undergoes magnetic-pulse processing. By means of the X-ray spectral analysis method, the effect of magnetic-pulse processing on the crystal lattice parameters of the hard alloys components, from which the cutting plates are made, has been studied. The change in the crystal lattice parameters of cobalt and titanium carbide is indicative of the hard alloy hardening. The most rational values of the crystal lattice parameters for the examined hard alloys under various magnetic-pulse processing modes have been analyzed and stated. The increase in reliability of turning tools for heavy-duty lathes under laboratory and factory conditions has been proved. Based on the conducted long-term operational tests of the assembly lathe-tools tips, it has been demonstrated that magnetic-pulse processing increases the cutting tool operation stability as evidenced by a twofold decrease in the stability dispersion range and coefficient of variation. Rational modes of magnetic-pulse processing to obtain the crystal lattice parameters of the components of hard alloys used for heavy-duty lathes pre-treatment have been determined.

Keywords: reliability, carbide-tipped turning tool, heavy-duty lathe, strength, magnetic-pulse processing.

Experimental analysis of vibroactivation process of concrete mixing in gravity vibromixer

K.V. Malakhov[1, a], D.V. Lobanov[2, b]

[1]Tyumen State Oil and Gas University, 47 Respubliki st., Tyumen', Russia
[2]Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]kirill@007.ru, [b]d_lobanov@mail.ru
Received 12.04.2013, accepted 2.08.2013

Concrete and mortar are artificial materials produced from a mixture of binders (cement, lime) and aggregates (crushed stone, gravel and sand). The basic physical and mechanical properties of concrete, particularly its strength properties, are highly dependent on structure uniformity. Therefore, when preparing the concrete mix, one should aim at achieving as great homogeneity as possible that depends on both the mixture properties uniformity and the distribution efficiency. One of the most effective ways to increase the quality of concrete is its vibration treatment. The description of the experimental gravity vibromixer presented in this article as well as the research analysis of the concrete mixing process based on the results of comparing the concrete strength time prepared in the mixer with vibration and without it, help visualize the effectiveness of introducing vibration in the mixing process. Vibration enhances the intensity of the process, which leads to the mixing time reduction and intensifies the concrete setting process, especially at early stages. These benefits facilitate the output capacity expansion and prevent possible downtime in the operating procedure, and, in addition, the reduction in energy intensity will allow reducing mixing time and increase productivity.

Keywords: concrete mixture, vibration, vibration treatment, activation, cement dough, vibratory exciter, strength, mixing time, gravity mixer.

Optimization of the composition and process parameters for manufacturing porous ceramic building materials based on silica fume and organic additives

N.A. Lokhova[a], A.S. Tarnovskaya [b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]nlokhova@yandex.ru, [b]tarnovskaja@rambler.ru
Received 21.04.2013, accepted 28.07.2013

With a number of metallurgical and wood-chemical enterprises, Bratsk undergoes unfavourable environmental conditions, including waste accumulation in slurry pits. It is necessary to find ways to use effectively siliceous waste (gas purification dust of the ferroalloy production) and organic waste (waste spillage of spent carbon lining crushing from aluminium electrolyzers). Within the research conducted at Bratsk State University to produce wall ceramics, the possibility of argillous raw material replacement by the above-mentioned man-made organic waste has been considered. The research objective is to optimize the charge composition, specific moulding pressure and firing temperature for silica ceramic material containing organic additive. This article demonstrates the results of the studies of ceramic materials based on silica fume with the wood chemistry by-products additive (rich thallous saponified acids (RTSA)), spent carbon lining from aluminium electrolyzers. The comprehensive data analysis has showed that the use of aqueuos solution of RTSA has a significant effect on the behavior of the material porous structure. Introduction of 0.2% of RTSA under the pressure of 16 MPa and at the firing temperature of 900^0C leads to a substantial reduction in the opened porosity and water absorption and in compaction and hardening of the material.

Keywords: porous ceramic materials, material strength, water absorption, softening factor, silica waste.

Porosity control of ceramic material produced from gas purification dust of ferroalloys production and modified liquid glass

N.A. Lokhova[a], N.V. Boeva[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]nlokhova@yandex.ru, [b]boevanatalija@rambler.ru
Received 26.04.2013, accepted 28.07.2013

The use of micro-porous industrial wastes - gas purification dust of the ferroalloy production (GPDFP) in manufacturing wall ceramics requires developing ways to increase frost resistance of the ceramic porous matrix. This can be achieved by controlling the structure porosity. The possibility of manufacturing the effective GPDFP-base wall ceramics using the high-calcium fly ash additive obtained from brown coal burning and modified liquid glass as a porous structure modifier is being studied at Bratsk State University. It has been established that the introduction of the fly ash additive in the amount of 25% of GPDFP weight and firing at 750^oC allows obtaining the material with minimum amount of open porosity and the maximum amount of conditionally closed pores that contributes to better frost resistance. Additional studies of frost resistance have shown that the GPDFP-base ceramic material withstands 125 cycles of alternating freezing and thawing while maintaining low average density of the crock (1140 kg/m^3). The conducted thermotechnical calculation proves that the use of the proposed wall ceramic material of the developed composition will allow reducing the wall thickness in comparison with clay ceramics.

Keywords: micro-porous ceramics, wall ceramics, micro-silica, high-calcium ash, thermotechnical calculation.

Predicting volume yield and type of sliced veneer on the basis of information-mathematical modeling of cut layers and their evaluation

N.O. Begunkova[a], S.P. Isaev[b], O.I. Begunkov[c]

Pacific National University, 136 Tikhookeanskaya st., Khabarovsk, Russia
[a]natali-beg@mail.ru, [b]Sisaev@mail.khstu.ru, [c]begunkov@mail.khstu.ru
Received 22.05.2013, accepted 12.08.2013

The type of sliced veneer we obtain depends not only on the rip-cutting technique of round wood (blocks) but also on the block's form as it has been revealed by our research. The block generator form can be presented as a straight line, parabola or semicubical parabola. In their previous papers, the authors developed the round wood mathematical models when the block generator form was a straight line or a parabola. This article contains the updated mathematical models applicable for virtual cutting when the block generator's form is a semicubical parabola. It allows covering almost all types of block forms obtained in the process of tree-length cutting and predicting more objectively the type of veneer, its texture and volume yield. The methodology and the results of calculations to predict the volume yield and type of sliced veneer have been provided.

Keywords: round wood, mathematical model, annual ring, sliced veneer, type of veneer, wood texture, prediction.

Features of forming structure and properties of the modified liquid glass composition

M.Yu. Ivanov

Bratsk State University, 40 Makarenko st., Bratsk, Russia
nis@brstu.ru
Received 24.05.2013, accepted 21.08.2013

The results of the research into the formation of the structure and properties of the modified liquid glass composition made of microsilica have been presented. The composition and the technique to obtain the porous structured modified liquid glass composition to produce effective granular heat insulation material have been developed. The mechanisms of changes in the liquid glass composition characteristics (synthesis time, kinematic viscosity, surface tension) depending on its silica modulus, the kind and quantity of modifiers: active mineral admixtures (burnt clay and fly ash), intermediate and by-products of the sulphate cellulose wood processing (sulfate soap, tall oil pitch and saponified tall oil pitch) have been revealed. These modifiers help reduce the surface tension at the raw material mixture phase boundary and increase the number of contacts, which, in turn, favorably affect the process of obtaining the liquid glass composition as a whole. The structure formation processes and their relationship with the properties of the modified liquid glass compositions made of microsilica have been studied. The introduction of burnt clay and fly ash contributes to the increase in the crystal phase of the liquid glass composition (the bonding strength increases and a greater degree of silicon-oxygen anions polymerization is observed). The sulfate soap, tall oil pitch and saponified tall oil pitch admixtures make for increasing the X-ray amorphous phase (the presence of the cellulose essential components has been established).

Keywords: liquid glass, liquids glass composition, silica modulus, microsilica, modifying addmixtures, granular heat insulation material

Improvement in buoyant of tree-length rafts formed on the territory flooded by the reservoirs

M.V. Stepanishcheva

Bratsk State University, 40 Makarenko st., Bratsk, Russia
ivanovva55@mail.ru
Received 3.05.2013, accepted 13.08.2013

One of the promising ways to increase the efficiency of timber transportation is to reduce wood density by means of dehydration. For railroad transport, the reduction in wood density affects the delivery speed or the increase in cubic capacity transported at one haul, while in case of automobile transport, it allows increasing truck load of the hauling rig. The reduction of wood density has especially great influence on water transportation when individual floating, bag boom towing and rafting are greatly effected by timber buoyancy. The reduction in density before the beginning of round timber rafting is primarily a decrease or elimination of losses in the form of sunken timber, the possibility to exploit forest areas of hardwoods and larch, which have insufficient reserve buoyancy but are widespread. The dynamic situation in the water absorbing capacity of timber formed into float units that allows formulating the optimization principle while forming the rafts on the territories flooded by the reservoirs has been examined.

Keywords: soakage, capillaries, surface, cone, cylinder

Improvement in the development processes of high-clayey sands goldfields

N.P. Khrunina[a], A.Yu. Cheban[b]

Mining Engineering Institute of the Far Eastern Branch of the Russian Academy of Sciences, 51 Turgenev st., Khabarovsk, Russia
[a]npetx@mail.ru, [b]chebanay@mail.ru
Received 4.05.2013, accepted 8.08.2013

The research results of high-clayey sands at one of the goldplacer deposits of the Amur region have been considered. It has been found that the studied gold placers sands are complex enough for disintegration due to their heightened clayey content and high content of iron oxides and montmorillonite in some samples, which predetermines the existence of hydrostable ties and the swelling ability phenomenon leading to some difficulties in the destruction process. The analysis of the studies in the field of disintegration of high-clayey sands has been given. The brief overview of the results of the research on ultrasonic disintegration

of high clayey sands is provided. It has been pointed out that the use of ultrasound under industrial conditions is limited by the ultrasound equipment manufacturing capabilities. New techniques of the mineral product destruction through the vortex flow of hydraulic fluid with maximum energy of acoustic resonant excitation in the given frequency range when using the hydrodynamic effects of vortex and by using shock-wave exposure on original high-clayey sands and their slurries are analyzed. A new method of deep disintegration of high-clayey sands by means of the developed wellfield complex based on the aerohydrodynamic impact as well generating the forced vibroacoustic vibrations is proposed. The proposed technology of high-clayey sands deep disintegration will ensure high intensity of material destruction in large volumes under low power intensity, operational continuity, high performance, reliability and lengthy service life.

Keywords: high-clayey sands, deep disintegration, ultrasound, vibtarion impact.

Cavitation mathematical simulation in the process of barking in aqueous media

V.A. Ivanov[a], G.D. Gasparyan[b]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]ivanovva55@mail.ru, [b]garik.gasparian@yandex.ru
Received 17.05.2013, accepted 4.08.2013

The article reveals the main results of the theoretical study of the ultrasonic barking principles based on the methods of the physical processes mathematical simulation. To optimize the parameters of round timber ultrasonic barking, it is necessary to develop mathematical models of various processes occurring while implementing the technology. Ultrasonic barking is a complex system of processes occurring in different parts of bark layers and the barking environment under the influence of ultrasonic waves. In the process of studying the ultrasound parameters, the basic principle of the physical impact on the bark elements is a process of cavitation effect formation that allows synthesizing various processes to separate bark from wood. One of the factors of the effective ultrasonic barking is the cavitation effect indicator that occurs in the area of ultrasound action. In this regard, it is necessary to develop a comprehensive cavitation effect model showing the feature determination of energy arising during this process. The cavitation effect produced in the area of destruction of bark elements and layers can be roughly differentiated into two phases: the emergence and dynamics, the cavitation bubble growth and collapse. Since the ultrasonic debarking occurs in aqueous media, the hydrodynamic flows are formed in the process of the cavity emergence and dynamics, and the energy damaging the layers is released during the collapse. The model dependence of the ultrasonic radiation parameters forming the hydrodynamic flows and cavitation effect has been examined.

Keywords: barking**,** ultrasonic technology, bark, processing procedure, timber, wood processing company, cavitation effect, cavitation, technological systems.

Wooden low-rise housing construction based on rational use of timber

V.P. Lugovaya

Moscow State University of Civil Engineering (MGSU), 26 Yaroslavskoye road, Moscow, Russia
lug-valeriya@yandex.ru
Received 4.05.2013, accepted 14.08.2013

The article considers the best practices in the construction technology of wooden frame low-rise houses with waste wood filler. The heat-insulating filler - cellulose wool – is a flaked cellulose fiber made of recycled newspapers containing fire-retardant and antiseptic additives. All the components of the material are non-toxic, non-volatile, human-friendly natural components. They prevent decay and efflorescence effect of the material and are fireproof. Cellulose wool is a hygroscopic material due to the filamentous structure of cellulose fibers. It doesn't lose its heat conductivity when it is wet. Such a feature of cellulose wool allows the house to be air-permeable without forming condensate. The material is applied on the upper, lower and inclined floorings as well as on the walls. When being installed, it fills all the joints, pockets passing through the smalllest holes and providing joint-free insulation. The material is easy to produce and apply, environmentally friendly, fire resistant and permeable to moisture. The technical and ecological characteristics of the material in comparison with similar heat-insulating materials as well as the ways of its placing and the used equipment have been provided. The application advantages as compared with a slabby or rolled insulant and the economic indicators of its use have been given.

Keywords: cellulose wool, placing method, plant to produce cellulose wool.

Solution of rational nature management problems by the example of north baikal province deposits

L.I. Khudyakova[1, a], O.V. Voyloshnikov[1, b], S.S. Timofeeva[2, c]

[1]Baikal Institute of Nature Management, SB RAS, 6 Sakh'yanova st., Ulan-Ude, Russia
[2]Irkutsk State Technical University, 83 Lermontov str., Irkutsk, Russia
[a]lkhud@binm.bscnet.ru, [b]ovod@binm.bscnet.ru, [c]timofeeva@istu.edu
Received 4.05.2013, accepted 19.08.2013

During the period of intensive mineral resources development, a lot of attention is paid to the environmental situation issues. Among all the waste, a key part belongs to the mining waste including magnesium silicate rocks forming copper-nickel deposits. The possibility of utilization of the mining waste in the form of magnesium silicate rocks by the example of the Yoko-Dovyren massif has been considered in the article. They are presented not only by massive rocks, but by the loose crust of mechanical weathering (sand) as well. Their reserves amount to billions of tons. The physical and mechanical properties of gravel and sand produced from these types of rocks have been studied. It has been established that they are of high quality. They are hard rocks, they do not contain any grains of soft rock and are of high grade as to their crushability. Dunite sand refers to the group of coarse sand. It has been demonstrated that these rocks may be used as coarse and fine aggregate in the process of heavy concrete manufacture and in road construction. The obtained concrete has high physical-mechanical properties. Its strength is higher than the strength of the concrete produced using granite and quartz sand. The coefficient of water resistance is equal to 0,85-0,87, its frost resistance is 50 cycles. The magnesium silicate rocks may be used for earth road filling and for laying asphalt concrete in road construction as well. Using the mining waste makes is possible to organize a low-waste production while developing mineral deposits and to decrease the ecological stress on the environment.

Keywords: mining waste, magnesium silicate rocks gravel, dunite sand, heavy concrete.

Effect of improvement thinning on pine and spruce competitive relationships in mixed forest stands

D.A. Danilov[1, a], T.A. Ishchuk[2, b]

[1]Leningrad Research Institute of Agriculture «Belogorka», Russian Academy of Agricultural Sciences, 1 Institutskaya str., Belogorka, Gatchina district, Leningrad region, Russia
2St. Petersburg State Forestry Engineering University, 5 Institutsky lane, St. Petersburg, Russia
[a]stown200@mail.ru, [b]rabbit0189@mail.ru
Received 26.04.2013, accepted 22.08.2013

Growing mixed conifer stands it is necessary to know when their competitive relationships become aggravated in order to prevent increasing attrition and to redirect growth to more economically valuable part of plantings using improvement thinning. The growing conditions determine the competitive relationships in the mixed coniferous cenoses. Depending on the species biological properties, when thinning one can dilute their influence on each other to a certain extent distributing evenly the layers in the environmental niches. However, depending on the improvement thinning technique, the competition between the pine and spruce layers may be increased, not reduced, on sandy soils of bilberry-type forest. The models of the pine and spruce diameter distribution represented on the plots were compiled for the objects under investigation. The indicators of the species close packing measures using R. MacArthur's principle of the ecological niches "close packing" (the ecological niches differentiation) reflecting the competitive relationships between pine and spruce have been calculated. When performing improvement thinning, it is necessary to approach differentially to the method of the stand layers thinning depending on the cultivated species target. Under the existing ecological conditions, it is more rational not to place spruce in the same layer with pine to avoid aggravating the species competition and increasing attrition. Maintaining the leading position of the pine layer will allow making the optimal use of the site conditions as the spruce layer has less performance on sabulous soil. By the liquidation cutting age, one should leave no more than two units of spruce in the mixed conifer forest stand.

Keywords: pine and spruce stands, competition, ecological niche, improvement thinning, species close packing measure, diameter distribution.

Investigation of the structure and parameters of cedar pine cones porosity

V.A. Ivanov[a], P.V. Byrdin[b], D.V. Mikhal'sky[c]

Bratsk State University, 40 Makarenko st., Bratsk, Russia
[a]ivanovva55@mail.ru, [b]byrdin_pavel@mail.ru, [c]nokia 603007@mail.ru
Received 14.05.2013, accepted 12.08.2013

*To improve the operational efficiency of artificial reforestation and increase labor productivity and quality of the obtained pine nut, a number of devices to shell cedar pine cones were developed to avoid nuts damaging in the process of their extraction. The operating principle based on the separation of a cone scale from its skeleton demanded carrying out the pilot studies to determine the parameters of a scale's material. The article presents the results of the conducted pilot research of the radial cuts of cedar cones scales when magnified 40 times. The research objective was to determine the porosity parameters of the cedar cones scales. Using the obtained cuts, the pores number was counted, their geometrical dimensions were determined, and the pores area was calculated. At the first stage of the pilot studies, the average number of pores per a scale's unit area was determined, and at the second stage, the studies to determine the average area of pores were conducted. At each stage of the research, the statistical data processing to detect the distribution nature was carried out. It was established that the pores distribution along the cut area was described by the normal law, and the distribution of the pores area by pores quantity was described by the normal distribution as well. As a result of the conducted research, the average pores number accounting for 1mm^2 of the area and equal to 40 and the average pore area equal to 10.6*10^{-3} mm^2 were determined.*

Keywords: cedar pine cone, porosity, pore number, geometrical dimensions and size of pores.

Assessment of green planting quality (through the example of public lawns of Krasnoyarsk)

E.V. Avdeeva[a], V.F. Nademyanov[b], N.V.Maslyuk[c]

Siberian State Technological University, 82 Mira av., Krasnoyarsk, Russia
[a]e.v.avdeeva@gmail.com, [b]valentinnademyanov@mail.ru, [c]natam17@mail.ru
Received 17.05.2013, accepted 17.08.2013

Green lawns have a health promotion effect, they are aesthetic, decorative, environmentally friendly, significantly improve the quality of urban environment. The lawn formation is an effective way to clean the air, prevent loss, dispersion and erosion of soil. In the article, the technique of assessing the lawns quality has been considered. The effect of micro-climatic conditions and technological impacts of Krasnoyarsk on the growth and development of grass stands has been studied. The analysis of moisture conditions in Krasnoyarsk in relation to the lawns layout and maintenance demonstrates that in general, the urban area is well provided with rainfall for normal growth and development of lawn grass except for May and September. The area regularly experiences extremely dry weather conditions for lawn grass to grow and develop. Lawn plants are often exposed to excessive moistening due to heavy rainfall in short periods of time or when rainfall is unevenly distributed. Periods characterized by high rainfall are followed by the relatively drought ones. The grass stand quality assessment is a complex task. It depends on the type of grass, season, subjective characteristics and the purposes for which the lawns will be used. The assessment of public lawns has been conducted according to the following indicators: projective cover, species composition, engineering and technical condition of the territories, anthropogenic stability. While surveying the lawns of Krasnoyarsk, the basic qualitative and quantitative characteristics have been obtained. The major causes for the lawns degradation in urban areas have been revealed, the high-risk areas for the lawn grass growth and development have been identified.

Keywords: lawns, projective cover, species composition, quality assessment.

Expert system for estimating the condition of power oil transformers

A.V. Khlystikov

Bratsk State University, 40 Makarenko st., Bratsk, Russia
al@stemi.ru
Received 7.05.2013, accepted 19.08.2013

The functions of the systems for monitoring and diagnostics of power oil transformers have been considered. The systems data comparison to select the field of application for each of them has been carried out. The application features of the systems for monitoring and diagnostics to organize the scheduled maintenance operations and fault forecasting have been revealed. The operating advantages of the integrated system for monitoring and diagnostics that allows using larger amount of decision-making information have been described. The diagnosis model allowing broadening the expert system knowledge base with reliable and tested through practice facts for more accurate and effective decision-making at further operation has been developed and described. The structure of a three-level expert system has been described, namely the level of sensors, the level of controllers-collectors of indications and the level of industrial computers realizing artificial intelligence of the whole system. The equipment being the basis for each level has been considered. The selection of the monitored key parameters of the power transformer performance has been made, and the monitoring methods have been selected as well as. The criterion to assess the transformer operability has been developed, its possible states have been described and the decisions, which the expert system is to offer in each situation, have been provided.

Keywords: power transformers, monitoring, diagnostics, expert system, performance forecasting, technical condition**.**