

ABSTRACTS

E.Ya. Voronionok, S.D. Knoring, O.M. Paliy, V.M. Shaposhnikov

RESEARCH OF EFFECT AN ECCENTRICITY OF STRUCTURAL REINFORCEMENT OF PLATES ON FATIGUE CRACK PROPAGATION

The effect on fatigue crack grows in plates with an eccentricity of design reinforcement is considered. By fracture mechanics methods are defined condition of forming of a curvilinear search pattern and crack rate. As the curvilinear crack is longer than rectilinear, on its development before fracture it is required to affix the greater numbers of cycles loading. The regulation of structure resource are marked at the expense of measures connected to small geometrical changes of design elements and structures.

Evgeny M. Appolonov, Michail A. Koudrin, Elena A. Maslich, Valery M. Shaposhnikov

FATIGUE STRENGTH ESTIMATION FOR A SHIP HULL WITH A DEVELOPED SUPERSTRUCTURE MADE OF A POLYMER COMPOSITE MATERIAL

The work is aimed to estimate fatigue strength of prospective ships with developed superstructures made of a polymer composite material (PCM) and subjected to cyclic loads due to hull global bending. The paper includes investigations into the stress deformed state (SDS) of the system superstructure-hull under the global bending, fatigue strength verification of mostly stressed details ensuring superstructure connection with the hull, as well as development of recommendations on the rational structural design of these details.

SDS is investigated by the finite-element analysis. Basing on the universal software ANSYS, a global finite-element model and sub-models have been developed for the system superstructure-hull and for individual structural details correspondingly.

G.N.Zabawsky, I.V.Nowitskaya, S.V.Petinov and I.V.Ryskina

ON ACCOUNT FOR STRESS CONCENTRATION IN FATIGUE ASSESSMENT OF WELDED DETAILS

Over 30 years ago at a seminar of the National Society of Shipbuilders, late A.I.Maximaggi and one of the above authors presented a paper on the mentioned subject. The following developments of the methodology of fatigue analysis showed that the thoughts expressed so many years back remain the same important.

The current rules for fatigue assessment of welded structural details (e.g., Reports of fatigue of IACS, IIW, etc.) recommend the two means of considering the detrimental effects of stress concentration. One of these requires that the “structural” stress concentration factor or respective local maximum stress (hot-spot stress) attributed to the effects of the detail geometry solely would be evaluated at the feasible crack initiation site. The role of the weld shape is assumed accounted for in the appropriate S-N curve for the given welded joint class. The second method (the “local stress approach”) also would need in structural stress concentration factor. This should be multiplied by the local stress increase due to the weld shape, the “weld stress concentration factor”. The latter may be approximated from the handbook data or computed using the finite-element method. Material fatigue resistance this turn is characterized by the only S-N curve, alternatively for parent or weld metal, depending on the crack location properties.

Several numerical and experimental analyses proved applicability of the mentioned approaches under certain conditions. These findings coupled with simplicity of the procedures, easy rules for

computing the structural stress concentration developed by IIW were the arguments for introducing the approaches into the rules for fatigue design of welded structures.

Meanwhile, the results of recent international projects and particular research works indicate that in general the standard procedures for fatigue design may be not correct. This is mostly because the current technologies are incorrect due to the physical and mechanical inadequacies with respect to the fatigue process. The first means that fatigue is associated with macro and microplasticity of material and consequently, the linear elasticity can not result in physically appropriate fatigue parameters. Secondly, even when the linear elastic behavior is assumed, the notch can not be presented as combined shape components when the stress at the notch root is assessed. The product of stress concentrations for individual shape components (structural and weld stress concentration factors) is always larger than stress concentration found for the superimposed actual configuration. The paper demonstrates the said in case of superimposed semicircular notches and of a realistic critical location at the bracket ending.

Gennady V. Boitsov

ANALYSIS OF STRUCTURE ELEMENT CRACK RESISTANCE

Basic design functions characterizing kinetics of fatigue crack development in conditions of regular and irregular cyclic loading are considered and estimated quantitatively. A procedure for assessing the fatigue crack initial size depending on stress concentration parameters is proposed. Quantitative data illustrating possible conditions of stationarity and critical development of cracks are presented. Stress gradient effects on crack kinetics are estimated.

Gennadiy V. Egorov

ON NECESSITY OF WIDENING OF NOTION ABOUT ASSUMED LOADS WHEN DESIGNING THE SHIP HULL STRUCTURES

In this paper the review is made of the so-called off-design loads and conditions, which render essential influencing on the merchant ships hull reliability and safety. The special role of such effects for ships intended for transportation of hazardous cargoes is shown.

Gennadiy V. Egorov

DEFINITION OF DESIGN EFFECTS AND CONDITIONS FOR SHIP HULLS DEPENDING ON THE NAVIGATION AREA

The practical necessity is proved to have the matched harmonized classification for the sea-going, mixed sailing area, and inland-water ships. Such classification should facilitate and provide more objective nature to the activities of the insurers, cargo owners, charterers, flag administrations, port authorities, from one side, and determine hazardous loads and conditions when designing ship hulls being optimal from the point of view of metal consuming for the assumed geographical sailing area, from the other side.

Gennadiy V. Egorov

CAP - ESTIMATION OF THE GROUP OF THE HOMOGENEOUS HULL MEMBERS

It is shown, that to get reliable CAP rating of the ship hull members, one should apply empirically obtained integral diminution curves, instead of their models in the form of known distribution laws, the usage of which could result in substantial error.

Gennadiy V. Egorov

ESTIMATION OF THE SUMMARY CAP – RATING OF THE SHIP HULL

It is shown that estimation of the summary CAP – rating over hull should be made on the basis of summation of the individual CAP – ratings of the member groups with account of the importance degree of the latter. The problem is considered of estimation of the relative importance of the elements constituent to the ship.

V.V. Kozlyakov., N.N. Sivoborodchenko

SPECIAL FEATURES OF ESTIMATION AND SECURING OF THE SEA-GOING SHIPS HULL FATIGUE RESOURCE

In the report a comparison is made of the fatigue resource of the typical welded hull units of the sea-going transport ships of length 100 to 400 m, pursuant to the 56.1 IACS-1999 recommendations.

The stress range for deck of $C_B = 0,80$ are taken following to Weibull law, with extreme value $\sigma_{.8} = 211,4 / \eta(\sigma_{.7}) = 211,4 \div 310,8$ MPa with the recommended shape parameter $k = 1,1 - 1,17 \cdot 10^{-3}(L - 100)$.

Calculations were carried out for the bilinear kind of the fatigue curves in the form HSE and IIW at 3 combinations of exponents $m_2 = m_1$; $m_2 = m_1 + 2$; $m_2 = \infty$.

The results testify to essential differences of fatigue resource at variation of the unit type, ship length, therefore the procedure recommended by IACS is conditional and requires considerable adjusting and introducing of the reasonable safety factors at structures design.

E.P.Lukash

OPTIMIZATION OF RELIABILITY PARAMETERS OF SHIP CONSTRUCTION

The algorithm of realization of reliability tasks of complex ship designs is considered. On the basis of an assumption about constant of the vibration modes during optimization initial model is essentially simplified. With the help of a method of linear programming is found approached global minimum and vector of controlled parameters, which can be specified at the following stage of optimization by methods of casual search. The algorithm is realized as the program module.

YU.S. Vasiliev, A.I.Alhimenko, A.S. Bolshev

SYSTEMS OF COMPUTER AIDED DESIGN AS A MAJOR ELEMENT IN FORMATION OF THE ENGINEER-BUILDERS IN XXI CENTURY

In the report the problems of the engineers formation adequate to the modern requirements are considered. The necessity of large using computer aided design systems and programme packages in the educational process ensuring significant rise of efficiency of engineering works is grounded. Methodical and organizational SPbSPU efforts directed on the extension of learning of computer aided design systems for formation of the engineers-builders are outlined.

E.M. Appolonov, A.B.Nesterov

PERFECTING THE MODEL OF ICE DYNAMIC FAILURE UNDER IMPACT INTERACTION WITH A SHIP HULL

A hydrodynamic model (HDM) of solid body impact about the ice (Kurdiumov's - Kheisin's model) specifying functional dependence of pressures in the force contact zone versus the main impact parameters is applied widely in the Russian practice of ensuring ice strength for ships and icebreakers. However, experimental investigations conducted in the nineties showed that a pressure parabolic pattern following from HDM contradicts to the observed in the experiments peak character of the pressure distribution in the contact zone. The paper considers two directions of HDM perfecting.

An ice dynamic failure model under local crushing is proposed. It permits to obtain the pressure peak distribution observed in experiments. The model describes the following two processes: ice failure (local crushing) in the contact zone center due to direct interaction with a solid body and extruding the layer of the fine-dyspersated failed ice outside the contact zone that is considered by the well-known main hydrodynamic model differential equation.

V.I. Alfiorov, G.V. Boitsov

INVESTIGATION INTO ULTIMATE STRENGTH OF TEE-SECTION AND TRAPEZOID-SECTION BEAMS BY THE FINITE-ELEMENT METHOD

Ultimate strength estimation for tee-section beams with bracket strengthening and trapezoid corrugations is conducted by FEA. Comparison of the obtained results with analytical estimations by a technique presented in "Standard Methodological Recommendations (SMR) for Sea Ship Structure Strength Calculations" has demonstrated satisfactory agreement of the computed values under actual relationships between structural parameters of details. For some range of parameters' ratio corrugation ultimate strength is lower than under corrugation strength analysis by the conventional beam section approximation.

Gennady B. Kryzhevich

CONSIDERATION OF THREE-DIMENSIONAL CHARACTER OF SHIP BOW FLOW FOR ESTIMATING HULL DYNAMICAL LOADS

A double layer potential method is applied to evaluating additional liquid level rise in the ship bow (relatively the sea surface) with account of flow three-dimensional character. The ship wetted surface (external pressure surface) is modeled by a double layer situated on the undisturbed water surface. Basing on numerical estimations of ship wetted surface width increase, which were obtained in assumption of forming an extrusion wave and the three-dimensional character of bow flow, corrections to analytic formulae for evaluating slamming loads and forces causing ship wave vibration were proposed.

The performed work permits to increase the accuracy in calculating loads due to side slamming and wave-induced vibration for ships of mixed operation, as well as for large tankers and bulkers with fuller bow lines. Owing to this, a possibility of increasing the design quality for such ships and guaranteeing their structure strength more safely appears.

Gennady Kryzhevich, Gennady Boitsov

PRACTICAL METHOD FOR CALCULATING SHIP WAVE-INDUCED VIBRATION

Results of development of a ship wave-induced vibration determined mathematical models in the form of a differential equation with varied coefficients are presented in the paper. Effects of wet ship surface variation caused by seas upon characteristics of energy dissipation under oscillations, as well as upon parametric phenomena due to changeability of inertial characteristics of the system “a ship-ambient liquid” in waves are taken into consideration. Basing on the solution of a flat problem on ship cross section penetrating into the liquid, a force structure governing the hydro-elastic oscillations was determined, and refined expressions for external forces causing fast ship wave-induced vibrations were obtained. The model permits to perform quantitative estimation of structural and operational factors’ effects upon vibration amplitudes under regular waves.

Besides the determined model, a probabilistic one was proposed; this model permits to estimate probabilistic characteristics of wave vibration amplitudes and their connection with wave-induced bending moment amplitudes basing on information obtained with the help of the determined calculation.

The proposed method for calculating wave vibration amplitudes essentially differs from familiar approaches to studying this phenomenon. In the work a new mechanism of exciting hull elastic vibrations caused by action of relatively short (in comparison with the hull length) waves is considered in the paper. Great attention is paid to the analysis of vibration parametric exciting owing to caused by seas changeability of the vibrational system inertial parameters. The important value of wave effects on the hull for the waves, encounter frequency of which is lesser by times than the hull global vibration base tone frequency, was ascertained. By using parabolic approximations of the theoretical drawing lines, the analytic relationships were reduced to relatively simple expressions.

The performed work permits to increase essentially the accuracy of establishing ship hull external loads occurred under wave-induced vibration, to estimate more correctly the influence of ship structural parameters and ship service characteristics upon vibrational loads. Owing to this, a possibility to increase the quality of ship designing and to guarantee fast ship structure strength and reliability more safely arises.

I.A. Vorontsov

A TECHNIQUE FOR EVALUATING HYDROSTATIC LOADING ON FLOATING DOCK HULLS

The executed researches of hydrostatic loading on floating dock hulls are described. The technique allowing to receive magnitudes of loading with sufficient accuracy is developed, including cases of operational restrictions for floating docks. It is recommended instead of used in Russian Maritime Register of Shipping Rules and corrects their lacks.

Sergei V. Antonenko, Oksana A. Zolotova

SOME FEATURES OF STRENGTH OF PONTOON FLOATING DOCKS

The calculation of steel floating dock’s stressed - strained condition is carried out with the usage of structural plate idealization. Load was applied to the dock as responses of the keel track on a part of its length and of buoyancy forces distributed uniformly along the whole bottom area. Stress distribution due to the dock’s general longitudinal bending, the height of side wings sagging,

pontoons' longitudinal bending and the step between the pontoons were analyzed. The essential errors of traditional design schemes were revealed.

A.P. Anosov

TO A QUESTION ON DEFINITION OF EFFECTIVE STRESS CONCENTRATION FACTOR

On the basis of the thermodynamic theory of weariness influence of geometrical parameters of the concentrator on size of effective stress concentration factor is appreciated.

V.N.Trjaskin, A.I.Svistunov, V.I.Spiridopulo

RESEARCH OF WAVE LOADINGS ON THE SHIPS OF SEVERNOE PROJECT DESIGN BUREAU WITH APPLICATION OF AUTOMATED SYSTEM "FREGAT_K "

The structure of the program block for definition of wave loadings on the hull of the ship is considered. Methods of the spectral theory of casual processes are applied at calculation of wave loadings. The information on some results of research of wave loadings for the ships of various classes is given.

E. Baskakova, V. Tryaskin

ASSESSMENT OF WAVE LOADS ACTING ON THE SHIPS OF RIVER-SEA NAVIGATION TYPE

The causes of river-sea navigation ships hull construction typical damages initiations are discussed, the question of assessment of wave loads acting on the ships of such type is affected for several regions of their exploitation. This approach was realized in the software "DIOL-M", which allowed to construct short-term and long-term distributions of ship's rolling and wave loads acting parameters.

V.N.Trjaskin

METHODICAL BASES AND EXPERIENCE OF APPLICATION OF THE AUTOMATED SYSTEM FOR CHECK OF CONFORMITY OF THE SHIP HULL TO REQUIREMENTS OF RULES OF THE RUSSIAN REGISTER OF SHIPPING

Experience of application of the first version of the specialized automated system for check of conformity of the ship hull to requirements of «Rules for classification and construction of steel ships» of the Russian Register of Shipping in the decision of practical tasks of definition a technical condition of a vessel at the next survey or at carrying out of procedure of renovation is discussed. Methodical principles on which this system developed in the department of the Ship structures of SPb SMTU is based are considered.

A.P. Butin, Yu.I. Efimenkov, O.Z. Stepanov, V.G. Chuprikov

BASIC PRINCIPLES OF REGULATION OF CONDITIONS OF A SINGLE TRIP REALIZATION BY A RIVER-SEA VESSEL OUTSIDE OF NAVIGATION ZONE ALLOWED

We consider a new regime of operation of a river-sea vessel – a single commercial trip outside of navigation area (season) allowed. This regime is occupying an intermediate place between the regular service and a transfer trip. The quantitative method to determine the conditions for such a single trip is based on estimating the long-term probability that the wave bending moment acting on the vessel hull exceeds some given safety limit. This moment is determined under the conditions that the vessel has to hide from the storm because of the incorrect forecast of the wave height.

S.V. Kalenchuck, D.A. Fedorenko

PROBLEMS IN APPLICATION OF THE NEW ICE CLASSIFICATION TO FISHING VESSELS IN SERVICE

The problem of an estimation of a technical condition of small fishing vessels in ice belt region is considered. The problem is caused by discrepancy of strength of ice belt of this vessels to new requirements of Russian Maritime Register of Shipping Rules. Ways of mitigation of the existing contradiction are offered due to the account of actual distribution of factors of the form on length forward ice belt region .

V.G. Chuprikov

SPECIFICATION OF THE ACCOUNT OF IMPACT INTERACTION OF A HULL OF A VESSEL WITH WAVES IN THE RULES OF THE RIVER REGISTER

The table of the correction factors, differentiated depending on length and class of a vessel, as multipliers to factor which is taking into account impact interaction of a hull of a vessel with waves in the Rules of the River Register is offered. The table is derived by serial calculations for vessels with regularly varied parameters on the algorithm based on reliable findings of rough-water trials of some of internal and river/sea vessels.

Shemenduk G.P., Gutnik A.A., Krivenko O.A.

EXPERIENCE OF A DECREASE OF STRESS CONCENTRATIONS IN THE UPPER GIRDER PR. 1743, 17437

After reclassification on the class II limit region of the Marine Register the ships of the designs 1743, 17437 were exploited within five years and after the next survey and repair were omitted on following five years' operation period. Contrary to waiting, the wear of hulls of ships has appeared small, that has allowed them to receive estimation "operable".

However during the previous five years' period in the time intermediate and extraordinary surveys were executed modernization with the purpose of removal of cracks in places of stress concentration. These regions of the hull frequently are damaged because of design solutions conventional for river shipbuilding, but invalid in marine shipbuilding.

The hulls of these ships are strong tense and the non-observance by them by crews of ships of the directed navigation areas is quit probable at exploitation, that can cause originating of some fractures in solid set constructions, however mass occurrence of fractures is watched in regions with high stress concentration, for which one and the measures were designed.

V.A. Postnov, G.A. Tumashik

OPTIMIZATION OF A CANTILEVER BEAM LOADED BY NON-CONSERVATIVE FORCE

The problem of optimum distribution of a material of a beam along its length from condition of deriving of maximum value of the critical flutter force is studied. The nonlinear optimization problem is reduced to a solution of sequence of linear programming tasks. As an example the optimization of a beam loaded by follow-up force is considered. The effect of strains of transversal shear strain, forces of interior and exterior resistance is also allowed.

V.A. Postnov

IDENTIFICATION OF BEAM SYSTEMS BY USAGE OF TWO EXPERIMENTALLY RECEIVED NATURAL FREQUENCIES AND CORRESPONDING THEM NATURAL BENDING FORMS.

New method of identification of elastic rod systems is offered below. Its essence is demonstrated on an example of identification of a beam creating transversal flexural free oscillations. The possibility of definition of distribution laws of a mass and flexural stiffness along the beam length is showed. For this it is necessary to know if two natural frequencies (arbitrary) and corresponding them natural forms and also the whole mass of the beam. It is supposed that the last necessary information can be obtain from an experiment.

M.J. Mironov, A.A. Rodionov

RESEARCH OF STRESS-STRAIN STATE AND OPTIMISATION TECHNIQUES OF SHIP STRUCTURES UNDER IMPACT LOADING

The paper deals a universal methodic for definition of optimal mass or stiffness of ship structures by constraints of parameters dynamic stress-strain state by impact loading. The response of shell-models of structures is calculated with finite element method for adjusted time. The problem of search the extreme of quality operator come to problem of iterative search the extreme value of function with Lagrange multipliers defined.

G. S. Lazarovitch, M. N. Sivers

ON THE INTERACTION BETWEEN FLEXURAL AND RADIAL VIBRATIONS OF THIN CIRCULAR CYLINDRICAL SHELLS

The effect of small initial deviations from the ideal circular shape on the frequencies and modes of natural vibrations of circular cylindrical shells is studied with the use of the linear theory shallow shells. It is assumed that the initial deviations are responsible for interaction between flexural and radial vibrations of the shell. The modal equations are derived by the Bubnov – Galerkin method. It is shown that the initial deviations split the flexural vibration spectrum, and the fundamental frequency decreases compared to that of the ideal shell.

N.F. Ershov, N.V. Ershov

THE VIBRATION FLEXIBLE TIE, WHICH LOSS STABLE EQUILIBRIUM IN STRUCTURE OF CONSTRUCTION

The definition frequency transversal free vibration strip and plate, which loss stable equilibrium in structure of construction.

N.V. Malikh

NOTES ON PITCHING AND HEAVING SHIP “RIVER-SEA” TYPE

Author analyzes methods of calculation pitching and heaving parameters of a ship in regular waves. These methods don't give correct results to “river-sea” ships. Also the account contains results of ship model test.

YU.V.Malyshevsky, A.A.Rodionov

SENSITIVITY INDEXES AND THEIR USAGE AT DESIGNING OF HULL STRUCTURES OF A DEEP-DIVING VEHICLE

The problems of a sensitivity analysis method of confined structure parameters and objective function of the purpose to changes varied by a variable are esteemed for its usage during designing of optimum deep-diving vehicle hull structures. The sensitivity indexes of a objective function of the purpose are submitted in the explicit form. Variables of state, which one reshape constrains of a problem of optimization, have no an explicit form, they were determined as a result of numerical procedures.

A.I. Frumen

COMPARISON OF NUMERICAL MODELS FOR ROUND OF COVERS WITH RIBS OF VESSELS, WORKING UNDER PRESSURE

The engineering scheme of designing of round covers with ribs on distribution pressure is built. The solved of the problems of definition of stress-strain of such covers in volumetric setting by finite element method. The comparative analysis of outcomes is conducted at usage of different types of finite elements (FE) of the volumetric task of a theory of elastic strength: on a basis 8- nodal FE with 24 degree of freedoms; 4- nodal FE with 24 degree of freedoms; 10- nodal FE with 30 degree of freedoms and 20- nodal FE with 60 degree of freedoms.

A.I. Shitov

THE MUTUAL CORRELATION BETWEEN STRUCTURAL STRENGTH AND BUCKLING CHARACTERISTICS OF SUBMERSIBLES PRESSURE HULLS

In Russian practice, in order to calculate structural strength and buckling resistance of submersibles pressure hull plating and framing, they use formulae derived by Russian scientists, founders of submarine structural mechanics P.E.Papkovich, V.F.Segal, V.V.Novozhilov and A.I.Koudrin. Basing on these formulae, main hull configuration parameters (plating thickness, frame spacing) are determined from design checks of structural strength and buckling resistance of the plating between the frames. Design check estimation criterion is the satisfaction of inequalities that include the relevant safety coefficients. The formulae, the structural strength and buckling resistance criteria used for calculations, and the assumed safety coefficients form an interconnected system.

With the exact equality in structural strength and buckling resistance criteria, there was obtained a relationship between the plating safety coefficient and the coefficient (η_2) that takes into consideration deviations from the Hooke law in critical pressure calculations. Basing on this relationship, relative critical pressure of the plating was plotted versus the η_1 coefficient that determines production technology effects (generally, the initial camber) on the buckling resistance. The performed analysis enabled to suggest formulae for determination of plating thickness in relation to the U parameter. Based on these formulae, one can determine the optimum spacing (ℓ) permitting to decrease the plating thickness and, accordingly, the relative ship weight.

The relative ship weight is determined by the above thickness that includes the frame cross-section area. Frame dimensions are established by frame structural strength calculations and buckling analysis for the entire shell together with the frames.

Assuming the exact equality in frame structural strength and buckling resistance criteria, a relationship was obtained between the theoretical critical pressure of the entire shell and safety margin assumed for calculations, which permits ensuring their optimum correlation for reducing the relative weight of the ship.

B.V. Druzhilovsky

CALCULATED-ANALYTICAL DEFINITION OF STRESSES AND DISPLACEMENTS OF CYLINDRICAL SHELLS WITH BOUNDARY CONTOURS OF DIVERSE COMPLEXITY

The paper contains in comparison plan results calculated-analytical decision of simple and complicated problems of stresses and elastic displacements of:

rectangular cylindrical panel,

cylindrical pipe of limited length with hard circular appendix.

Results of the paper could be used for ensuring strength of hulls constructions.

S.S.Novikov, J.A. Smirnov, V.N.Trjaskin

SOME PROBLEMS OF THE HULL STRUCTURES DESIGNING OF THE UNDERWATER CONTAINER VESSEL

Problems of the hull structures designing of the transport vessel intended for transportation of general cargoes in containers in underwater position are considered. The information on basic results of designing and researches received on the basis of special calculations is given.

B.I. Antonov

A STATICS OF SHALLOW SHELLS

The stiffness matrix of a shallow shell finite element of arbitrary triangular shape is received. Each nodal point of a finite element, conterminous to its vertices, has 12 degrees of freedom, namely: tangential displacements u, v and their first derivatives and also normal displacement w and its first and second derivatives. The considered finite element enables effectively to solve static tasks of a shallow shell of constant curvature.

Vladislav M. Grekov

SOLUTION OF SOME PARTICULAR PROBLEMS OF P.F. PAPKOVICH FOR AN INFINITE WEDGE

The paper contains results and conclusions on the work covering the solution of the first basic problem of the elasticity theory for a flat infinite area under various options of concentrated and distributed normal, tangent and moment external forces on the area edges in its plane. Familiar solutions in Riman-Mellin integrals are transformed to a form in functional series on residue of integrands, which is used further for obtaining numerical results.

Vladislav M. Grekov

THE PLANE STRESS DEFORMED STATE OF A CIRCULAR PLATE

A familiar general solution of the elasticity theory for the plane stress deformed state of a circular plate is concretized for a particular case of force boundary conditions, in which normal and tangent external forces vary along the circular coordinate by a law of trigonometric functions.

L. S. Kryzhevich, V.G. Romanov, A.G. Taubin, V.A. Boulkin

EXPERIMENTAL STRENGTH RESEARCH FOR ANGULAR CONNECTIONS OF FIBERGLASS PLASTIC PANELS OF INCREASED THICKNESS

Strength tests under static bending and tension were conducted for structural details. To specify the test conditions, the structural details were analyzed, and the obtained results were examined. Plating material standardized characteristics were evaluated. The theoretical and experimental results were compared. A conclusion on correspondence of fiberglass plastic strength properties to its standard characteristics was formulated. Recommendations on detail designs were given.

O.S. Kouklin, V. Yu. Shoungin

FORMING SHELL ELEMENTS BY MINI-FORCE STAMPLESS ROTARY-LOCAL DEFORMING

Forming plate details of engineering structure platings is one of the most important technological operations effecting directly quality, reliability and appearance of the structures, as well as labor intensity and cost of their production. Recently rotary-local methods of forming metal-roll have been widely applied in shipbuilding and allied industries. Basing on results of new research works in physics of elastically plastic deforming plate metal-roll in Central Research Institute of Shipbuilding Technology, the scientific foundation for rotary-local deforming processes was developed.

O.S. Kouklin, V. M. Levshakov

FORMING SPHERICAL STRUCTURE ELEMENTS BY ELASTICALLY PLASTIC SUCCESSIVE LOCAL DEFORMING

In various industries stamp-welded structures for shells, bottoms, bulkheads and their elements are applied widely. Increase of overall dimensions, thicknesses and strength characteristics of blanks, as well as enhancement of requirements to the structure quality put new tasks in technology of manufacturing these structures and finding new forming methods.

G.A. Jivotovski, A.A.Rodionov

STRENGTH COMPUTATION OF HYDRFOILS FOIL STRUCTURES

Strength computations are fulfilled for a bow foil structure of a Kometa type hydrofoil using the developed technique. The foil structure is modeled as a spatial frame. The external loading is evaluated using a vortex - lattice method. Structural, stability and frequency analysis is carried out by means of the Finite Element Method based on ANSYS linked with hydrodynamic software AUTOWING.

G.A. Jivotovski, A.A.Rodionov

PROVISIONS OF CLASSIFICATION SOCIETIES TO FOIL STRENGTH ANALYSES OF HYDROFOILS

A comparative analysis is given for provisions of Russian marine register of shipping, Russian river register, Bureau Veritas, Germanischer Lloyd and Registro Italiano Navale to foil strength of hydrofoils. The covered by Russian and foreign code hydrofoils, loading conditions and values of external forces, recommended structural models and allowable stresses are compared.

V.I. Alfiorov, V.S. Mikhailov

A TECHNIQUE FOR CALCULATING RESIDUAL STRAINS IN CYLINDRICAL AND SPHERICAL STRUCTURES UNDER WELDING COAMINGS INTO BY THE FINITE-ELEMENT METHOD

A technique for establishing welding strains in complicated 3D structures with using the welding strain theory and the finite-element method is proposed. Examples of strain calculations under coaming welding into cylindrical and spherical shells are given.

V.A. Goumeniuk, A.V. Yakovlev, Yu.G. Ivanov, V.A. Soulzhenko, N.A. Kazakov

ADVANCED POSSIBILITIES OF THE ACOUSTIC EMISSION DIAGNOSTICS

Advanced possibilities of the acoustic emission diagnostics at manufacture, tests and maintenance are considered.

Manoukhine Vadim

THE TRIANGULAR SAIL STRESS ANALYSIS

The problem of stress distribution inside triangular sail is discussed. The analytical expressions for the sail stress and rig force are received. The influence of sail form peculiarity on stress and force is analysed. The numerical examples are cited.

Oleg P. Knyshev

ABOUT FAILURE OF A LARGE SCALE BAR UNDER UNIAXIAL TENSION

A large scale bar in tension is considered as a 3-D loaded structure. The 3-D stressed state of the bar is examined.

An example of such failure was obtained experimentally. A constant similar to K_{Ic} was established.