ABSTRACTS

Oleg Konstantinovich Morachkovsky - known scientist - mechanic (70-th anniversary) / D. Breslavsky // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 3-12. – Bibliogr.: 50. – ISSN 2078-9130.

The biographical sketch about the prominent scientist in Mechanics, doctor of technical sciences, professor Oleg Konstantinovich Morachkovsky is presented in a paper. The brief biography of scientist is presented. The basic courses have been developed by him for students at departments of Dynamics and Strength of Machines and Theoretical Mechanics are described. The basic scientific results were obtained by O.K. Morachkovsky in different parts of Mechanics, such as Creep Theory, Continuum Damage Mechanics, Theory of Plates and Shells are described. The examples of research and development activity of scientist in area of Dynamics and Strength of machines and structures are presented.

Keywords: biographical sketch, creep, damage, anisotropy, irradiation effects, shells, theoretical mechanics, kinematics and dynamics of machines.

The numerical analysis of deflected mode of the cylindrical tanks with pincers / A.I.Ainabekov, K.V.Avramov, U.S.Suleimenov // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 16-19. – Bibliogr.: 7. – ISSN 2078-9130.

The deflected modes of the cylindrical tank with spherical pincers are investigated. The software ANSYS, which is implemented the finite element method, is applied to calculate the deflected mode. The dependence of the stress concentration factor on the pincers parameters is investigated. The approximate polynomials for the stress concentration factor are obtained. On the basis of the finite-element analysis approximating ratio for factors of pressure concentration which can be used at calculations of cylindrical tanks with various pincers are calculate.

Keywords: cylindrical tank with spherical pincers, static deflected mode, stress concentration factor.

Functioning electromagnetic vibration oscillators of low frequencies / A.E.Bozhko, Z.A.Ivanova, E.M. Ivanov // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 20-21. – Bibliogr.: 3. – ISSN 2078-9130.

In this paper we investigate the problem of building mathematical models and block-diagrams of the oscillations of the platform to resonance and resonant regions of the electromagnetic exciters. Electromagnetic exciters are widely used in vibrating test stands. They must operate in a wide range of frequencies (low frequencies up to $2 \div 5$ mm, and high - tenths of mm), especially in those cases when it is necessary to test (engines vehicles, etc.) that is suitable for performance, so as in this case, the amplitude of the oscillations acting on the test object, varies within wide limits. This, in turn, imposes certain requirements on the choice of the value of the air gap of the electromagnetic vibration exciter based on the maximum values of the amplitudes of the oscillations and the presentation of certain requirements the springs of the movable part of an electromagnetic vibration exciter, operating in a wide frequency range.

Key words: the air gap, the amplitude of vibration, resistance, inductive resistance.

The creep of reinforced concrete structural elements / D. Breslavsky, A. Chuprynin, N. Sereda // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 22-25. – Bibliogr.: 10. – ISSN 2078-9130.

The paper is devoted to the description of numerical method for the estimation of creep in concrete structural elements. The equations describing the creep of concrete as well as their use for different modes of loading and concrete grades are regarded. The method of calculation, allowing the determination of stress – strain state of reinforced concrete constructions under the action of instant and long-term loading, and based on Finite Element Method (FEM) is presented. The example of numerical simulation of reinforced concrete plate from beamless ceiling is regarded, the stress relaxation data after ten service years are presented.

Keywords: creep, isochrone, reinforced concrete construction, FEM, thin plate.

Destruction front proliferation at creep in plates with snips / G.O.Anischenko // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 26-31. – Bibliogr.: 6. – ISSN 2078-9130.

Development of the time determination methods between the completion stage hidden destruction of the constructive element and point of its complete destruction is relevant for creep research and operation life evaluation of the various machine elements. These elements loosened by various snips and work in difficult temperature and power conditions. Based on the proposed method of numerical analysis of destruction front proliferation the results of the damage accumulation analysis due to the creep and the propagation time determination of front destruction in plates are presented. These plates are weakened by sharp and circular symmetrical snips. Sharp or circular snips concentrators are quite common in machine elements and have a constructive or technological importance. It was found that the complete destruction time of the plates in a non-uniform stress state due to the stress concentration around the snips greatly exceeds the latent stage duration of destruction. The practical value of the proposed method lies in the fact that there is the ability to assess resource of the different machine parts, in which the period of hidden damage accumulation is ended and macro destructions are emerged.

Keywords: snips, stress concentration, damage, creep, fracture.

Influence of the structural state of the metal in its deformation characteristics / K.V.Vakulenko, I.B. Kazak, S. Yu. Sotrikhin, V.G. Yareshchenko // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 31-34. – Bibliogr.: 5. – ISSN 2078-9130.

The paper discusses the practical means of determining the reliability of a design method of controlling the degree of degradation of the structure of the material during exploitation. Surface hardening to create a surface layer of material is a structural condition that increases the resistance to fatigue crack nucleation prevents (or difficult) accumulation, movement and access to surface defects in the crystalline structure of the material. The article is dedicated to the use of strain gauge method for the detection of nucleation of fatigue cracks in steel subcritical dimensions and elements of supporting structures. The instrumental method can reduce the costs of the trial operation structures with prolonged initially appointed for a period of exploitation. The experimental data obtained by the strain-measuring method and fixing metal ball rebound in good agreement.

Keywords: surface hardening, shock loading, strain gauges, deformation.

Strength of bandage and coupling fiberglass pipe fittings / S. M. Vereshchaka, V. V. Daniltsev // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 35-42. – Bibliogr.: 11. – ISSN 2078-9130.

The proposed experimentally-theoretical method of calculating the strength of binding and coupling of GRP pipes. Three options were considered binding compounds that have structural differences. In the first classic version of the thick tubes at the point of intersection is taken constant. In the second embodiment, the connection is accepted in condition, when the pipe thickness decreases linearly from the outside to the ends of adjacent pipes. The second option binding compounds were more rational, based on the strength conditions. Reducing the thickness of the pipe wall at the joint and thus reducing its rigidity, it is possible to achieve conditions of optimal redistribution of the efforts in this connection.

The comparison of calculation results on the strength of the proposed method with the experimental data proves its effectiveness. It is noted that the destruction of fittings possible because of the low ultimate strength of the adhesive layer the deformations of shear and transverse separation. To allow for redistribution of loads between the joined pipes and the coupling is under internal pressure, you need to create a secure grip to ensure their joint deformation by increasing the adhesive properties of the adhesive layer. These conditions may be met by taking constructive decisions in terms of changing the form of coupling and methods of surface preparation of the ends of the pipes.

Keywords: bandage connection, coupling joint, flange connection, fiberglass pipes, modified strength criterion.

Nonstationary vibrations of a plate with additional viscoelastic support / A. V. Voropay // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 43-46. – Bibliogr.: 99. – ISSN 2078-9130.

Mechanical system consists of hingedly supported medium-thickness rectangular plate with additional concentrated viscoelastic support. The nonstationary concentrated transversal load, which initiates vibration, is acting on the plate. The simulation of the plate deforming is based on S. P. Timoshenko's refined theory. The calculations are reduced to the Volterra integral equations. The solving of such Volterra integral equations is ill-posed problem, which is solved numerically with using of Tikhonov's regularization method. Stable analytical and numerical solution of ill-posed problems for considered mechanical system is obtained without the use of iterative computational schemes. The unknown reaction between the plate and additional support vs. time are obtained consequently. The question concerned with the selection of Tikhonov's regularization parameter is considered. The results of numerical calculation for plate with additional viscoelastic support are presented.

Keywords: medium-thickness plate, nonstationary loading, concentrated viscoelastic support, Volterra integral equation, regularization method.

Study of strength longitudinal reinforced elements of foundation / S.V. Krasnikov // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 47-49. – Bibliogr.: 10. – ISSN 2078-9130.

Considered the strength of foundations for steam turbines. The results of the research strength of typical elements of the foundation are given. The foundation is the backbone of the steam turbine. Type of build the foundation - reinforced concrete. Various options twisting reinforcement concrete elements. Constructed two series models typical element. The first series models - concrete element models with different details. The second series models - concrete elements with different damage valves. For each series models is the basic design. For the first series design is the most common physical characteristics. For the second series basic model consists of typical concrete and reinforcement. Damage to the fittings look with two directions - quantitative and qualitative. The calculations of stresses, strains, displacements are completted. The analysis of parameters of strength are given. Particular attention is paid tension and displacement. The most detailed analysis done voltages typical element are made. The conclusions of damage valves are done. Make a list of the most significant types of damage valves. Modeling and calculations made with using finite element method.

Key words: performance, stress, strain, displacement, strength, foundation, steam turbine.

Elastoplastic deformation during manufacture of tubular blanks / V. Mietielov // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 50-53. – Bibliogr.: 9. – ISSN 2078-9130.

The problem of profiling pipes taking into account emergence of irreversible plastic strains is considered. The use of program complexes based on the finite element method (FEM), which are capable to reproduce real technological process with high precision, is proposed in the paper. Basic equations of calculation method are considered. Calculation model for the scheme of cold forming of pipes was developed. Calculation of stress-strain state of the profiled pipes with successive motion through the rolling mills were done.

Keywords: plasticity, FEM, modified lagrangian approach, stress-strain state, tubular bars, rolling mill, profiling of pipes.

Nonlinear vibrations of rotor on angular ball-bearings at the joint action of disbalance and vibration of supports / S. V. Filipkovskiy // Bulletin of NTU "KhPI". Series: Dynamics and strength of machines. – Kharkiv: NTU "KhPI", 2015. – № 55 (1164). − P. 54-58. – Bibliogr.: 10. – ISSN 2078-9130.

The model of nonlinear vibrations of rotor supported by axial preload angular ball-bearings was developed. The aim of this paper is research of nonlinear vibrations of rotor caused by the joint action of disbalance and vibration of supports. The amplitude-frequency characteristic of the system is obtained by the continuation method. Refining of decisions is executed on every step by the Newton iteration method. The amplitude-frequency characteristic for each resonance is soft. The analysis of periodic decisions showed that resonant mode of vibrations arose up not only on fundamental resonant frequencies but also on frequencies less of the resonant one in an integer times. The unsteady modes and character of bifurcations of periodic solution were investigated. The time dependences of phase coordinates and Poincaré maps are generated on these modes. There are saddle-node bifurcations on the left of the resonances. The oscillating movement becomes chaotic at these points. There are bifurcations of two-dimensional torus on the right of the resonances. There are beats at these points.

Keywords: rotor, angular ball bearing, nonlinear vibrations, resonance, bifurcation.