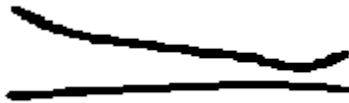


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Hydrodynamic Lubrication

1. EFFECT OF THERMAL BOUNDARY CONDITIONS UPON BEHAVIOUR OF A PUSH ROD HEAD BEARING

pp. 1 - 18

by Dominique SOUCHET, Stéphane PIFFETEAU & Dominique BONNEAU

Université de Poitiers France, Laboratoire de Mécanique des Solides,

Abstract: *Une procédure numérique a été développée pour analyser le comportement thermoélastohydrodynamique transitoire de paliers de tête de bielle soumis à des charges dynamiques. Les équations de Reynolds, de l'énergie dans le film et de la chaleur dans les solides sont résolues en utilisant la formulation éléments finis. Les maillages éléments finis des trois domaines sont interconnectés et les conditions de continuité du flux de chaleur entre les différents domaines deviennent ainsi implicites. Seules les conditions aux limites sur les contours des solides (extérieur de la bielle et intérieur du maneton) doivent être imposées.*

2. THE THERMAL STUDY OF AN AXLE VISCOUS COUPLING SUBMITTED TO A VARIABLE ROTATIONAL VELOCITY REGIME

pp. 19 - 26

by A. PREDESCU & R. M. CARP-CIOCÂRDIA

Polytechnic University of Bucharest - Romania

Abstract: *The present paper deals with the analysis of a multidisk viscous coupling whose rotational speed is not constant but has a variation imposed by actual functioning conditions. A multidisk viscous coupling is mainly composed of two packs of intercalated disks separated by relatively thin gaps filled with oil. As the pack of driving disks begins to revolve, torque is transmitted to the second pack of disks due to the shear stress that occurs in the oil film. Because of its constructive simplicity, the multidisk viscous coupling became nowadays widely used in automotive transmissions, for both inter-axle differentials and axle blocking devices solutions for two contact scenarios. In the present work we deal with an axle blocking device. When the vehicle runs on a slippery ground and a tire starts loss grip, the relative rotational velocity between the wheels increases, so that finally a tire is motionless and the other spin uselessly. However, if a viscous coupling is mounted on the axle, the relative rotation of the wheels generates a viscous torque between the driving and driven disks, which increases once the relative velocity increases, so that the axle is blocked. Although the idea is simple, serious difficulties occur when*

one tries to calculate the value of the fluid friction torque. Obviously, such a device would work properly if the maximum torque of the coupling is higher than the resistance torque given by the tire. The fluid friction torque on the temperature field in the coupling, since the temperature influences the oil viscosity. However, the temperature field is not constant and has to be known at any instant, which requires a transient calculus model. In the present work we also consider a variable regime of rotational velocity, that will be taken into account by a trapezoidal law. We determined the influence of this regime upon the temperature distribution on both radial and axial directions in coupling and the its effects on the fluid friction torque.

3. THERMAL ASPECTS OF A SINGLE FLOW COMBINED HYDRODYNAMIC BEARING

pp. 27 - 30

by Mihail IONESCU¹ & Vladimir IONESCU²

¹ "Stefan cel Mare" University of Suceava - Romania, Department of Applied Mechanics

² "Spiru Haret" University of Bucharest - Romania

Abstract: Une procédure numérique a été développée pour analyser le comportement thermoélastohydrodynamique transitoire de paliers de tête de bielle soumis à des charges dynamiques. Les équations de Reynolds, de l'énergie dans le film et de la chaleur dans les solides sont résolues en utilisant la formulation éléments finis. Les maillages éléments finis des trois domaines sont interconnectés et les conditions de continuité du flux de chaleur entre les différents domaines deviennent ainsi implicites. Seules les conditions aux limites sur les contours des solides (extérieur de la bielle et intérieur du maneton) doivent être imposées.

4. CHARACTERISTICS OF COMPLIANT BEARINGS OBTAINED BY NUMERICAL MODELLING

pp. 31 - 40

by Nicușor BUTNARU

"Stefan cel Mare" University of Suceava - Romania, Department of Applied Mechanics

Abstract: Due to the nature of the layer, the bearing may present large deformations and a non-linear stress-strain law applies. The investigation of compliant journal bearings is directed toward the fundamental behavior characteristics which are necessary when compliance is factored into the final design. The bond between the thermoelastohydrodynamic study of the contact and the calculation of the bush deformations has allowed obtainance of functional characteristics of a flexible bearing. Analytical determination of performance characteristics are shown as a function of the bearing flexibility. As the deformation coefficient increases, load capacity decreases and minimum film thickness will occur near the two sides of the bearing.

5. THEORETICAL MODEL FOR LUBRICATION OF ELASTIC SLEEVES BY AQUEOUS FLUIDS

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by Lorena TOMESCU, Călin TARĂU & Sorin CIORTAN

“Dunărea de Jos” University of Galați - Romania

Abstract: *This paper presents a theoretical model for lubrication with water-like fluids (non-compressible), in isothermal regime. Study on the profile parameters of the open bearings made of PTFE composites (roughness and waviness) after sliding in water in open circuit, support the hypothesis made for the simulation program.*

6. PHYSICAL PHENOMENA OF LUBRICATION BY EMULSIONS CONTAINING ORGANIC ADDITIVES OF FRICTION COUPLE STEEL-LSDA

pp. 51 - 60

by Mioara HAPENCIUC, Aurel HAPENCIUC & Vasile PALADE

“Dunărea de Jos” University of Galați - Romania

Abstract: *On présent les recherches expérimentales sur le comportement tribologique au glissement du couple de matériaux acier-bois stratifié compacté, lubrifié par des émulsions additivées par des substances organiques (huile de tournesol et savon solide) . Les résultats obtenus pour une émulsion additivée par des substances organiques sont comparés avec les résultats pour l'eau, pour le même couple de matériaux et les mêmes conditions d'essai. Nos recherches mettent en évidence la capacité lubrifiante des émulsions de la catégorie eau-huile, additivées par des substances organiques comparatif celle-là de l'eau circulante, utilisés pour la lubrification du couple de matériaux acier-bois stratifié compacté. L'oeuvre en propose aussi, à justifier les valeurs réduites pour le coefficient de frottement, établies dans certaines conditions de chargement et de vitesse, pour la loubrification du couple des matériaux acier-boie stratifié compacté, sur le fondement de la nature des matériaux en contact et sur l'effet des films adsorbés ou chémisorbés.*

7. INFINITELY WIDE STEP VISCOUS PUMP. PART I: MODEL OF STIFF ACTIVE SURFACES

pp. 61 - 68

by Radu-Mircea CARP-CIOCÂRDIA & Adrian PREDESCU

Polytechnic University of Bucharest - Romania

Abstract: *The paper deals with the model of infinitely wide step viscous pump in which the active surfaces of the pump are considered perfectly rigid. In this part, an original manner is used for a complete theoretical investigation of all the problems of such a pump (flow rate, frictional power loss, force due pressure distribution, efficiency – pressure dependencies; geometrical optimization for the increase of the performance characteristics).*

8. INFINITELY WIDE STEP VISCOUS PUMP. PART II: MODEL OF PLASTIC ACTIVE SURFACES

pp. 69 - 74

by Radu-Mircea CARP-CIOCÂRDIA

Polytechnic University of Bucharest - Romania

Abstract: *The paper deals with the model of infinitely wide step viscous pump in which the active surfaces of the pump are regarded as pressure compliant. In this part, an original manner is used for a complete theoretical investigation of all the problems of such a pump (flow rate, frictional power loss, force due pressure distribution, efficiency – pressure dependencies; geometrical optimization for the increase of the performance characteristics).*

9. STUDY OF A DOUBLE VISCOUS PUMP. PART I: NUMERICAL MODELS

pp. 75 - 86

by Radu-Mircea CARP-CIOCÂRDIA

Polytechnic University of Bucharest - Romania

Abstract: *The paper deals with the study of an original double frontal viscous pump. In this part, two original numerical models for theoretical investigation, based on finite difference method, are presented. In the first model the active surfaces of the pump are considered perfectly rigid, whilst in the second one, they are regarded as pressure compliant.*

10. STUDY OF A DOUBLE VISCOUS PUMP. PART II: COMPARISON OF EXPERIMENTAL AND NUMERICAL RESULTS

pp. 87 - 92

by Radu-Mircea CARP-CIOCÂRDIA

Polytechnic University of Bucharest - Romania

Abstract: *The paper deals with the study of an original double frontal viscous pump. In this part, the experimental results for three pumping fluids (H 46 oil, sun-flower oil, water with 5% "SUNIVRA 7") are compared in an original manner with the theoretical results obtained by using the two numerical models which are presented in the first part.*

11. THERMAL ASPECTS OF VISCO-PLASTIC SHEAR OF LUBRICANT FILMS

pp. 93 - 106

by Mircea BALAN & Emanuel N. DIACONESCU

"Stefan cel Mare" University of Suceava - Romania, Department of Applied Mechanics

Abstract: *As the shear of a lubricating film increases, the generated shear stresses rise monotonously. This increase cannot exceed the limiting shear stress of the lubricant, corresponding to the given operating conditions. Therefore, plastic shear of oil film occurs at a critical level of shear. This can affect the pressure generated inside the film and the general friction. Investigations concerning the effect of onset of plastic shear in a hydrodynamic plane pad upon load carrying capacity and shear stress distribution were performed by Huang & Wen for the case of a constant limiting shear stress across the film and by Diaconescu for a limiting shear stress linearly increasing with applied pressure. Both investigations were carried out in an isoviscous regime. In the second series of papers, Diaconescu indicated that the shear stress initiates at exit edge when certain conditions are met. Then, the plastic zone advances towards the centre of the pad. At an certain higher shear intensity, a second nucleus of plastic shear occurs at inlet and extends towards the centre. Eventually, at higher shear, the two plastic zones merge. This paper aims to improve the theory advanced by Diaconescu by introducing refinements. First, more shear regimes than previously suggested were taken into account, including that of a constant pressure along a certain length of the pad. Secondly, the thermal effects in the film are introduced to obtain more plausible results. To introduce these refinements, a new analytical approach is proposed, based on new differential equations for pressure and on new forms for the boundary conditions in the crossing points between shear zones. A computational program in Mathcad and Mathconnex was devised to establish automatically the shear regime corresponding to given initial conditions of the problem. This program generates maps of velocity, temperature, viscosity, shear stresses, pressure gradient and pressure across the film. The general conclusion is that once the plastic shear occurs and develops across the oil film, the pressure inside the film and therefore the load carrying capacity with respect to an equivalent hydrodynamic regime, decrease drastically.*

Basic and Applied Elastohydrodynamics

12. A TRIBOMECHANICAL SYSTEM: THE EHD CONTACT

pp. 107 - 114

by Louis FLAMAND

Laboratoire de Mécanique des Contacts, INSA de Lyon - France

Abstract: *L'analyse fonctionnelle d'un contact est complexe, car les phénomènes mis en jeu ont parfois mal connus, s'étalent souvent sur les échelles larges et sont toujours couplés. Dans de cas d'un fonctionnement de type élastohydrodynamique, cette analyse s'appuie sur des modèles robustes et bien validés. Cependant, la réalité des contacts déborde largement les hypothèses des contacts modèles et leur analyse doit être abordée de manière systémique et avec prudence. Cette présentation se propose de préciser cette démarche vis à vis de certaines des perturbations dues à la réalité des contacts.*

13. BEHAVIOUR OF EHD LUBRICANT FILMS UNDER RAPID VARIATION OF ENTRAINMENT SPEED

pp. 115 - 126

by Romeo P. GLOVNEA & Hugh SPIKES

Imperial College of Science, Technology and Medicine London

Abstract: *As on present time, elastohydrodynamic (EHD) lubrication is reasonably well understood, for steady-state conditions, research is beginning to focus on the behaviour of EHD systems under transient conditions. Many practical systems experience such conditions, including cams, gears, constant velocity joints and all components undergoing reciprocating motion, at start of the motion or coming to a halt. In the analysis of such systems, it is usually assumed that film thickness can be predicted from the instantaneous velocity using steady-state EHD theory. However such an assumption implies that there will be zero lubricant film thickness as soon as the entrainment velocity falls to zero, which is in contradiction with the behaviour often observed in practice. The aim of the work described in this paper was to investigate the evolution of lubricant film thickness in an EHD contact undergoing rapid, cyclic variation of entrainment velocity. The method for measuring the EHD film thickness used in the present study was ultra-thin interferometry using a high-speed video camera. The studied contact was formed between a glass flat disc and a steel ball. In order to obtain very rapid variation of entrainment speed the disc was kept fixed and only the ball was driven in a desired fashion. In the present paper a linear accelerated/decelerated variation of entrainment speed was studied. Because of low inertia of the ball*

motions with frequencies up to 100 Hz could be achieved. The arrangement enabled a contact image and thus a film thickness measurement to be taken every one millisecond. The velocity of the ball was synchronously recorded at the same rate. The results show a time lag of the film thickness behind the entrainment speed on sudden accelerating or decelerating events as expected according to other results of the authors.

14. INTERFEROMETRIC RESEARCH OF AN EHL LINE CONTACT

pp. 127 - 134

by Lucian SEICIU¹ & Peder KLIT²

¹ Polytechnic University of Bucharest – Romania

² Technical University of Denmark

Abstract: *The paper will present a testing rig for elastohydrodynamic lubricated (EHL) line contact film thickness measurements using the optical interferometry method. The rig is designed to reproduce as close as possibly real functioning conditions. The experimental results obtained on this rig will be presented in comparison with the ones made on a two disk (S.A.E.) rig. Also, it is presented a new approach in the understanding of the EHL line contacts.*

15. ASSESSMENT OF SHEAR REGIME OF LUBRICANT FILM IN A SLIDING-ROLLING LINE CONTACT

pp. 135-140

by Mircea BALAN & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *In order to appreciate the shear regime in a line contact EHD oil film, a procedure previously advanced by Grosu and Diaconescu was applied and extended for wider working conditions and for two pressure dependences of viscosity, namely Barus and Roelands. It was found that, as the shear intensity increases, Barus equation leads to initiation of plastic shear regime in the centre of the contact; then, the plastic zone extends towards the contact edges. A different behaviour is predicted by Roelands relationship: the plastic shear occurs at very high shear rates only, in the points of contact edges and evolves towards the centre line.*

**16. EXPERIMENTAL INVESTIGATIONS OF THE EFFECT OF CONTACT BODIES
GEOMETRY UPON EHD TRACTION**

pp. 141 - 146

by Alexandru POTORAC & Simion PATRAȘ-CICEU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *In the larger context of the study of EHD traction on punctual contacts between bodies with variable geometry, in this paper we experimentally determine the influence of the reduced ray of the curvature of the bodies in contact with traction curves, for different values of the maximum contact pressure.*

17. LOAD PRESSURE DISTRIBUTION ALONG CYLINDRICAL SPUR GEAR TOOTH FLANK

pp. 147 - 152

by Sorin CĂNĂNĂU

Polytechnic University of Bucharest – Romania

Abstract: *This paper proposes a tooth contact analysis for spur gears. In the first order is described a method which one can determine the contact pattern along tooth flank, including the case of axes misalignment. The load pressure distributions along tooth flank line as a function of contact pattern are calculated in the second part of the paper. This method is used to introduce geometrical corrections along tooth flank.*

18. ON ANGULAR CONTACT HYBRID BALL BEARINGS' REABILITY

pp. 153 - 162

by Viorel Paleu & Spiridon CREȚU

Technical University “Gh Asachi” of Iasi - Romania

Abstract: *The aim of this paper is to estimate the rating life of a 7206C hybrid ball bearing, in comparison with the rating life of similar all-steel bearing. A possible new method for hybrid ball bearing basic load rating estimation is proposed, starting from Lundberg and Palmgren's formulae, established for conventional steel bearings. Finally, the effect of hoop stresses on rating life of both hybrid and all-steel bearings, due to rolling bearing mounting on shaft and into the housing, and due to centrifugal expansion of shaft - inner ring assembly, is studied using a quasi-static model.*

19. THE RADIAL AND AXIAL STIFFNESS OF SPHERICAL ROLLER BEARING SYSTEMS

pp. 163 - 174

by Daniel REZMIREȘ, Spiridon CREȚU & Ioan BERCEA

Technical University "Gh Asachi" of Iasi - Romania

Abstract: Many technical applications which use the spherical roller bearings and spherical roller bearing systems works with high external load and moderate speeds. In that paper are presented two theoretical cases of rigidity matrix analysis: for the static case and for the quasistatic case respectively. Equations and their derivatives for finding the radial and axial stiffness of a spherical roller bearings and also for spherical roller bearings systems assuming a rigid shaft and housing, are given for any case of combined radial and axial load. The stiffnesses of two spherical roller bearings was investigated theoretically for an applied load, distance between bearing centers, size of bearings and combination of bearings.

20. THE LOAD DISTRIBUTION IN DOUBLE ROW SPHERICAL ROLLER BEARINGS AND SPHERICAL ROLLER BEARINGS SYSTEMS IN THE STATIC CASE

pp. 175 - 186

by Daniel REZMIREȘ, Ioan BERCEA, Spiridon CREȚU & Dumitru OLARU

Technical University "Gh Asachi" of Iasi - Romania

Abstract: This paper proposes an analytic formulation to simulate the mechanical interactions in double row spherical roller bearing and double row spherical roller bearings systems taking into account the type of the contact developed on the contact area and the contact angle modification as effect of the external load application. In this paper the relations who describe, the centre of the mass of the roller element displacement are presented. Correlating the geometrical particularities of distinct bearings, in this paper, using an analytical method, the geometrical interactions were founded. The interdependence between the external load and the bearing system response was takes into account.

21. NONLINEAR ANALYSIS OF BRISTLE RADIAL DEFORMATION IN INTERFERENCE BRUSH SEALS

pp. 187 - 200

by Traian CICONE & Mircea D. PASCOVICI

Polytechnic University of Bucharest – Romania

Abstract: It is generally accepted that actual high performance brush seals are interference seals and therefore, tribological behavior at the bristle-to-shaft interface is a major concern. As in any other

sliding contact, contact temperature is an important topic, which must be addressed. In a recent paper, Pascovici & Cicone [15] proposed a simplified elasto-thermo-tribological model for interference brush seals, which offers a closed form analytical solution for maximum contact temperature. The elastic model is based on classical linear beam flexure theory and includes several simplifying assumptions in order to obtain an analytical formulation for contact force corresponding to a given pre-load. However, the high elasticity of the bristles and possible large values of pre-load make questionable the assumption of linear deformation. The aim of the present paper is to evaluate the accuracy of the linear model by comparison with an improved, nonlinear elastic model. The results clearly show that the linear model is very accurate for a wide range of practical values of bristle dimensions and pre-load. The results can be easily extrapolated to include other effects like shaft run-out or mechanical and thermal elastic deformations. The model and the corresponding algorithm can be straightforward embedded in a numerical design procedure for brush seals.

22. ANALYSIS OF HEAT GENERATION AND TRANSFER IN BRUSH SEALS

pp. 201 - 212

by Mircea D. PASCOVICI & Traian CICONE

Polytechnic University of Bucharest – Romania

Abstract: It is unanimously accepted that wear in brush seals is a major concern that needs to be addressed in experimental and theoretical approaches. Although the contact temperature is an important parameter of the wear process, few attempts were made to measure or to model it. In a recent paper, Pascovici & Cicone [17] proposed a simplified elasto-thermo-tribological model for brush seals based on classical fin model for heat transfer in the bristle. Their analytical solution allows to estimate the contact temperature for interference brush seals assuming that all the heat generated by dry friction (unlubricated contact) at the bristle tip is rejected by convective heat transfer between the bristle and the sealed gas. In the present paper this model is extended to include heat partition between the bristle pack and the shaft. An analysis of bristle-to-shaft contact forces is also made. Closed form analytical solutions for heat partition coefficient and maximum contact temperature are proposed. A numerical example is given, showing the importance of heat transfer calculation. The proposed model can be straightforward embedded in a design procedure for brush seals.

Rheology

23. A NEW POSTULATION OF VISCOSITY AND ITS APPLICATION IN COMPUTATION OF FILM THICKNESS IN THIN FILM EHL

pp. 213 - 220

by Chaohui ZHANG, Jianbin LUO & Shizhu WEN

State Key Laboratory of Tribology, Department of Precision Instruments, Tsinghua University, Beijing, P. R. China

Abstract: *In this study, a viscosity modification model is developed which can be applied to thin film lubrication problems. The author believes that the viscosity distribution along the direction normal to the interface between liquid and solid surfaces can be approached by a function proposed in this paper. Based on the formula, lubricating problem of thin film elastohydrodynamic lubrication (thin film EHL) in isothermal and incompressible condition is solved and the outcome is compared to the experimental data. In thin film EHL, according to the computation outcomes, the lubrication film thickness is much greater than it is in Elastohydrodynamic Lubrication (EHL). While the velocity is adequately low (which equals to thin film thickness), the pressure distribution in contact area is very close to Hertzian distribution in which the second ridge of pressure is not obvious enough. The film shape demonstrates the earlobe-like form in thin film EHL, which is similar to EHL while the film is comparatively thicker. The transformation relationships between film thickness and loads, velocities or atmosphere viscosity in thin film EHL differ from those in EHL so that the transition from thin film EHL to EHL can be clearly seen.*

24. EXPERIMENTAL RESEARCH UPON LUBRICANT NATURE

pp. 221 - 226

by Simion PATRAȘ-CICEU, Alexandru POTORAC & Mihail IONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *This paper presents the procedure of determining by experiment the fundamental physical parameters of a simple molecular liquid ϵ and σ on which base one can find out all the other rheologic characteristics of the fluid. The numerical predictions of the newly advanced computer code are matched against closed-form solutions for two contact scenarios.*

25. RHEOLOGICAL RESEARCHES CONCERNING THE THERMICAL BEHAVIOR OF THE LUBRICATING GREASES

pp. 227 - 230

by Alexandru V. RADULESCU

Polytechnic University of Bucharest – Romania

Abstract: *The paper presents the studies for the thermal behavior of the lubricating greases, using a plastometer with a capillary tube. The plastometer was specially designed in order to be capable to determine the variation of the yield stress versus temperature. The experimental results have been numerically treated and a regression relation was obtained, similar to the relation between viscosity and temperature. As a final conclusion, the results were compared with those published in the literature.*

26. OIL SOLUBLE POLYMERS AND THEIR PERFORMANCES IN ROLLING/SLIDING CONTACTS

pp. 231 - 236

by Ion BERCEA¹, Viorel PALEU¹, Maria BERCEA² & Dumitru OLARU¹

¹Technical University “Gh Asachi” of Iasi – Romania

²“Petru Poni” Institute of Macromolecular Chemistry Iasi

Abstract: *The present paper discusses the influence of the addition of a polymer component on the film forming properties and on the wear under high pressure. The polymer properties and the processing concentration influence the lubricant performances. Experimental data show that the polymer concentration added to an lubricant oil plays an important role in obtaining greater film thicknesses and in preventing wear in elastohydrodynamic contacts.*

27. RHEOLOGICAL BEHAVIOUR OF LUBRICANTS IN FRICTION PEARS OPERATING WITH SELECTIVE TRANSFER

pp. 237 - 244

by Ilie FILIP

Polytechnic University of Bucharest – Romania

Abstract: *During the friction process of certain materials and in the presence of some adequate lubricants, the usage phenomenon is reflected in the material transferring from one of coupling element to the other one. This phenomenon lasts for a while, till a certain thickness is settled and after this the phenomenon is established the other way; the transferred stratum may return totally or partially, to the initial element. This phenomenon is specific to the selective transferring mechanism. At the contact point of the abrasion couplings that function on basis of a selective transfer, several physical – chemical*

processes take place, that encourage the phenomenon. An important role in the functioning of abrasion couplings, with selective transfer, has the rheological lubricant. That is way, this work presents the rheological behaviour of the glycerin, in the abrasion couplings that function with selective transfer, this glycerin being the lubricant, that contributes to the selective transfer.

28. DEGRADATION OF LUBRICATING CAPACITY OF SOME GREASES USED IN AGGRESSIVE ENVIRONMENT

pp. 245 - 252

by Nicolae DIACONU, Constantin GHERGHIES & Ion CRUDU

“Dunărea de Jos” University of Galați - Romania

Abstract: *In order to study the lubricant capacity of greases used in severe regimes, It was designed a stand with thermo-insulated room and auxiliary devices. This stand allows testing the grease behaviour in aggressive media and under heavy load. Infrared spectrometry is a good method for studying the modifications occurring in the molecular chains of tested greases.*

29. INITIAL STRESSES IN BIOLOGICAL SOLIDS

pp. 253 - 260

by Gheorghe FRUNZĂ

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *In its natural state, outside exterior forces, every body displays initial stress, which influences its behavior while fulfilling its function. Usual solid bodies, such as machine parts, electronic parts, composite materials, polymers, intelligent materials, biological solids, the initial stress may appear as a consequence of the manufacturing technology, due to contraction at solidification, due to crystal level effects introducing structure incompatibility, due to mounting errors, to temperature, or deliberately created. Biological solids feature a major characteristic, which any other engineering material lacks – it is the capacity of growing or shrinking. The live tissue can change dimension and, sometimes, mechanical properties. These changes are conditioned by exterior action, as well as by certain biochemical or biophysical processes which can change the stress filed in live tissue, in time – a property which is essential to life. Due to this stress, one cannot ascertain the absence of residual stress in the organism – that persists after the exterior forces have ceased action. A method ought to be found, which should enable the possibility to determine this stress, in order to determine the stress distribution in live organisms. Initial stress is important insofar as it is not null or uniform. Oftentimes, it is its effect which determines the way the biological solids – biomaterials displaying such stress – function. Thus, it is possible to observe certain phenomena, such as biomechanical fatigue, flow, and even break under critical loads; however, it may result in positive effects in particular, special conditions. The complexity of the study of the laws which govern the initial stress phenomenon yields form the necessity of taking into*

account the biomechanical, and biophysical-biochemical factors that may affect the operational process. Initial stress may provide information concerning the biomechanical anamnesis of each point in the body structure, as well as its evolution. Often, the history of such a body is unknown in the final stage, and very difficult to study in practice, so that such stress is generally unknown. Also, determining it analytically is neither an easy task to perform, nor at hand for any engineer. The issue of determining the initial stress is as a rule very complicated, while its potential solutions require theoretical investigation of the relevant biophysical and chemical processes. The present paper represents an approach to the origin and the factors that influence the apparition of initial stress, as well as to determining it theoretically.

30. THE CREEP OF ISOTROPIC MECHANICAL ELEMENTS SUBJECTED TO TENSION AND COMPRESSION

pp. 261 - 266

by Ion Florin POPA & Cornel MARIN

“Valahia” University of Târgoviște - Romania

Abstract: *Le but de cette oeuvre est de présenter une description mathématique du phénomène de fluage des éléments mécaniques soumis à sollicitation d’étirage et de compression. Dans le cas de ce phénomène, la vitesse de déformation n’est plus une fonction linéaire de la contraction (loi de Newton et Bailey). La visquo-élasticité des structures analysées n’apparaît plus comme un phénomène linéaire. C’est pour ça que pour l’analyse des phénomènes qui apparaissent à l’essai de traction-compression on tient compte d’un modèle visquo-élastique non-linéaire qui doit décrire la déformation des essais.*

31. NUMERICAL MODELLING OF TENSILE OF LINEAR VISCOELASTIC MECHANICAL ELEMENTS

pp. 267 - 272

by Ion Florin POPA & Cornel MARIN

“Valahia” University of Târgoviște - Romania

Abstract: *Le but de cette oeuvre est de déterminer le comportement des éléments de la construction des machines à la sollicitation de traction, en supposant que le matériel dont ils sont constitués a un comportement visquo-élastique linéaire. Pour un tel milieu, on interpose les effets de la viscosité conform à la loi de Hooke. L’étude des phénomènes qui apparaissent à la traction, étant complexe, il est nécessaire tant la réalisation d’une description mathématique des phénomènes que l’établissement des modèles visquo-élastiques linéaire d’étude. Sur la base de ces modèles on peut mettre en évidence très nettement les phénomènes distincts qui apparaissent pendant l’essai de traction: élasticité momentanée, élasticité retardée, retour élastique instantané, déformation linéaire, déformation permanente*

Friction and Wear

32. TRIBODIAGNOSTIC OF VEHICLE COMBUSTION ENGINES

pp. 273 - 278

by Jiří STODOLA

The Brno Military Academy, Czech Republic

Abstract: *This paper discusses ways to apply mathematical methods to evaluate the results of tribodiagnostics (ferrography) related to vehicle combustion engines. The idea is based on a discriminative analysis which makes it possible to describe one qualitative parameter, i.e., complex technical state of the engine, by means of several quantitative parameters, i.e., quantity of diagnosed wear particles in used oil. The results have been verified by means of considerable statistical data of T3 - 930 engines made in Czech Republic used in trucks and automobiles.*

33. EVALUATION OF ROLLING FRICTION COEFFICIENT BETWEEN BALLS AND RACEWAYS

pp. 279 - 286

by Ilie MUSCĂ

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *A rolling friction coefficient evaluation between balls and rings in ball bearings is presented. The test rig, cinematic and friction experiments are presented too. A direct correlation of rolling friction coefficient with rolling speed was observed.*

34. ASPECTS OF PTFE MATRIX COMPOSITES WEAR WHEN SLIDING ON STEEL, IN WATER

pp. 287 - 298

by Lorena TOMESCU & Constantin GEORGESCU

“Dunărea de Jos” University of Galați - Romania

Abstract: *This paper presents experimental results on wearing processes of PTFE and some composites with PTFE matrix. A tribomodel shoe-roller was used and the results pointed out the importance of adding materials on wear characteristics when the tribomodel was sliding in water in open circuit.*

35. PRESSURE DISTRIBUTION AND TOOL WEAR WHEN MACHINING VINKLER MATERIALS

pp. 299 - 306

by Carmen TACHE¹ & Andrei TUDOR²

¹“Valahia” University of Târgoviște – Romania

² Polytechnic University of Bucharest – Romania

Abstract: *In the cutting process, the cutter deforms elastically and plastically the material to a certain contact pressure, which is called the critical pressure. The crack appears in material at the critical pressure and then the crack propagates to the free surfaces of material. The wear model allows the optimization of the active angle, depending on characteristics of manufacturing material.*

36. CALCULATION MODEL FOR WEAR CARRYING CAPACITY OF A SLIDING CONTACT

pp. 307 - 312

by Ivona PETRE

“Valahia” University of Târgoviște – Romania

Abstract: *During the sliding process between two surfaces in contact, the mechanic work consumed by friction generates a certain quantity of heat which is dissipating among the elements of the couple. The contact pressures and the presence of the sliding speed in the presence of a thermal regime, define the portable capacity of surface from a certain material.*

37. CHARACTERISATION AND EVALUATION OF SURFACE TOPOGRAPHY BY USING ABBOTT CURVE

pp. 313 - 320

by Minodora RÎPĂ, Constantin SPÂNU & Virgiliu STOICA

“Dunărea de Jos” University of Galați - Romania

Abstract: *In engineering applications, many surfaces are manufactured to have some specific functional properties such as bearing, sealing and lubricant retention capabilities. The roughness parameters give general descriptions of surface topography. The paper presents evaluation methods based on the profile bearing ratio curve, in connection with the functionality and the tribological characterization of surfaces. Some research methods and their applications are presented. The Abbott curves for three representative engineered surface are discussed and compared. The method is applied for studying the changes of roughness parameters and surface functional properties, before and after wear tests.*

**38. DETERMINATION OF OPTIMUM SAMPLING CONDITIONS WHEN MEASURING
SURFACE MICROTOPOGRAPHY**

pp. 321 - 330

by Minodora RÎPĂ, Constantin SPÂNU & Virgiliu STOICA

“Dunărea de Jos” University of Galați - Romania

Abstract: *The selection of measurement parameters (for example, the sampling interval) therefore relies on the subjective experiences of users, for most measurements of surface roughness performed by digital techniques. Determination of appropriate sampling conditions is achieved studying the sampling interval influence (using four sampling values), on the digital profile (from a visualization perspective), on the variation of three roughness parameters and on the bearing ratio curve and features related. Experimental results based on measurements carried out on two types of engineering surfaces (using a stylus instrument) are presented to demonstrate the effectiveness of the appropriate sampling interval.*

Contact Mechanics

39. SERIES DEVELOPMENT IN BIPOLAR CO-ORDINATES OF BOUSSINESQ AND CERRUTI POTENTIALS

pp. 331 - 334

by Stelian ALACI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *An analysis of relations supplied by literature for series development of stress functions in bi-polar coordinates performed in this paper shows that these are incorrect. Such developments are required to solve many boundary problems in plane elastostatics. Consequently, the paper proposes new coefficients for the series developments which are tested and shown to be correct.*

40. THE STRESS FUNCTIONS FOR THE COMBINED BOUSSINESQ - CERRUTI PROBLEM IN THE CASE OF A HALF-PLANE CONTAINING A CIRCULAR HOLE

pp. 335 - 342

by Stelian ALACI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *The stress functions required to assess the stresses occurring in an elastic half plane that contains a circular hole by using Airy function are developed in the paper. The boundary of the half plane is loaded by a point force which acts either normally or tangentially with respect to the bounding straight line.*

41. DETERMINATION OF THE STRESS STATE IN A HALF-PLANE CONTAINING A CIRCULAR HOLE, LOADED BY A POINT FORCE ON THE BOUNDING STRAIGHT LINE

pp. 343 - 352

by Stelian ALACI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *In a previous work these authors determined the expressions of potential functions in bi-polar coordinates which were applied to evaluate the stress state in a half plane containing a circular hole in*

loaded by point forces in its boundary. This paper complements the previous by pointing out the specific aspects of the stress states, the limits of applicability of solution and validates the previously obtained relations.

42. UPON SUPERPOSITION PRINCIPLE APPLIED TO A HALF-PLANE CONTAINING A CIRCULAR HOLE, LOADED ON THE BOUNDING STRAIGHT LINE

pp. 353 - 360

by Stelian ALACI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *This paper aims to derive, by using the superposition principle, the relations for the stress state occurring in a half-plane containing a circular hole when a half elliptic distribution of normal load is applied on the straight boundary. A similar tangential distribution is then taken into account. Finally, the results of superposition principle are compared with those obtained by using Fourier series development of potential functions in bi-polar coordinates.*

43. BEHAVIOUR OF AN OPTIMISED CIRCULAR CONFORMAL CONTACT WITH LOAD LEVEL

pp. 361 - 370

by Marilena GLOVNEA & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *Many conformal contacts encountered in practice are modelled by an equivalent rigid punch having a constant cross-section pressed against an equivalent elastic half-space. In such a situation, the contact pressure reaches its minimum in the centre of contact area and tends towards infinity in contour points. This pressure riser diminishes the load carrying capacity of the contact and adequate design measures must be introduced to attenuate this effect. A widely recommended solution seeks to reach a constant pressure distribution over contact area. These authors proposed previously to modify the flat front surface of the punch in order to generate an uniform contact pressure at a nominal load and they derived analytical and numerical procedures to derive this punch optimum front surface. A new problem occurs now: it is required to find the pressure distribution, which occurs when such an optimised contact is subjected to other loads than the nominal. This paper deals with this problem for the simple case when the punch possesses a circular cross-section. Four contact domains are identified when the load increases. Initially, the contact behaves in a Hertz point contact fashion and then in a point non-Hertz one. When the outer radius of contact area equals the punch outer radius, the contact becomes conformal. This can be either under-nominal or over-nominal, as the applied load is less or exceeds the*

nominal load. The limits of load interval for each domain are found and for each domain equations for pressure distribution, outer radius of contact area, normal approach and stiffness are derived.

44. A NEW OPTIMISATION CRITERION FOR CIRCULAR CONFORMAL CONTACTS

pp. 371 - 376

by Emanuel DIACONESCU & Marilena GLOVNEA

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: A highly non-uniform contact pressure occurs in conformal or surface contacts. Feijoo and Fancello suggested to optimise these contacts such to obtain an uniform contact pressure. For an equivalent contact, Glovnea and Diaconescu developed a numerical method to optimise this way the front surface of the punch at a nominal load. Investigating the behaviour with load level of an optimised circular contact, they found that, as soon the load exceeds a limiting value, discontinuities in both stresses and displacements occur. A new optimisation criterion is proposed herein for circular surface contacts which assures continuous stresses and strains by generating a continuous pressure up to the maximum load. This consists of a central region with uniform pressure, surrounded by an annulus of elliptically decreasing pressure. The equation of the generatrix of punch surface that yields this pressure is expressed by two double integrals. These are solved numerically and the obtained optimum profile is approximated by an even polynomial function.

45. RESIDUAL STRESSES IN LINE CONTACT IN CASE OF ISOTROPIC HARDENING MATERIALS

pp. 377 - 388

by Spiridon CRETU & Gabriel POPESCU

Technical University “Gh. Asachi” of Iasi - Romania

Abstract: The solution of problems in elastic-plastic rolling contact is important for many practical operations in the rail, gear and bearing industries. Under repeated rolling contact, a body may reach a steady state of either elastic or plastic shakedown. Although shakedown limits are important in structural design, a detailed knowledge of the residual stress field is critical for accurate fatigue life calculation. Numerous studies presented in literature deals with analytical or the finite element methods by using various plasticity models. Although the calculation of residual stresses by the finite element method is in much better agreement with measurements than analytical methods, it has the shortcomings of long computational time. A new analytical method was developed by an extension of the Merwin-Johnson model in case of materials with linear or non-linear isotropic hardening behavior. Results obtained were compared with theoretical and experimental data presented in literature and a quite good agreement has been noticed in all cases.

46. PLASTIC DEFORMATION IN LINE CONTACT – A THREE-DIMENSIONAL ANALYSIS MODEL

pp. 389 - 398

by Gabriel POPESCU & Spiridon CRETU

Technical University “Gh. Asachi” of Iasi - Romania

Abstract: *An analytical method is presented in order to evaluate the permanent deformation developed in line contact loaded above the elastic limit in case of normal static loading. Finite line contacts are three-dimensional and the stress analysis must be performed numerically, including the edge effect. The real contact area and pressure distribution were obtained by a three-dimensional numerical analysis based on the flexibility matrices developed from the half-space theory. The internal stresses at any point within the half-space are obtained by the superposition principle. A three-dimensional strain deformation analysis based on the incremental theory of plasticity and the use of Prandtl-Reuss relations in conjunction with the von Mises yield criterion was developed. The non-linear material behavior was considered by the Ramberg-Osgood stress-strain relation for the AISI 52100 hardened bearing steel. Numerical analyses have been verified considering the plastically deformed geometries given in some experimental data presented in literature and the ones obtained by authors. An excellent agreement has been noticed between computed and measured final geometries.*

47. THE EFFECT OF LOADING FREQUENCY UPON CONTACT AREA IN A VISCOELASTIC POINT CONTACT

pp. 399 - 404

by Florina CIORNEI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *The contact problem of a rigid paraboloid pressed into a viscoelastic half - space by a dynamic force is considered. The effect of loading frequency upon the elements of the contact is revealed. The contact radius and the normal approach reach their maximum value simultaneously. At low frequencies, the maximum of contact area is obviously delayed with respect to force but at increased frequencies, the maximum contact radius tends to follow the force, though with reduced value.*

48. EVALUATION OF NORMAL APPROACH IN A DYNAMICALLY LOADED, VISCOELASTIC POINT CONTACT

pp. 405 - 412

by Florina CIORNEI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *The solution found by Ting, [Ti66], for the dynamic contact problem between an axisymmetric rigid and a viscoelastic half-space, is applied in the case of a rigid parabolic pressed on a Maxwell*

material by a particular load function. The expressions for the contact area and the normal approach are deduced and numerically solved for a loading cycle. The results reveal the effect of retardation time upon the variation of the contact elements.

49. L'INFLUENCE DES DEFORMATIONS ELASTIQUES SUR LES CONTRAINTES TANGENTIELLES A L'INTERFACE D'UN CONTACT

pp. 413 - 420

by Luminița IRIMESCU, Stelian ALACI & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *Ce travail étudie l'effet de la spatialité de surface de contact sur les contraintes tangentielles à l'interface d'un contact en roulement, chargé normalement. Afin d'évaluer ces contraintes, le micro-glissement relatif est calculé à partir des équations cinématiques fondamentales. Les résultats obtenus montrent la présence du micro-glissement sur l'aire de contact et l'existence des certaines zones avec micro-glissement positif ou négatif, séparés par lignes de non glissement. Les contraintes tangentielles sont obtenues numériquement pour contacts circulaires avec différentes géométries.*

50. LE FROTTEMENT INDUIT PAR MICRO-GLISSEMENT A L'INTERFACE D'UN CONTACT EN ROULEMENT

pp. 421 - 426

by Luminița IRIMESCU ¹, Emanuel DIACONESCU ¹ & Yves BERTHIER ²

¹ “Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

² Laboratoire de Mécanique des Contacts, INSA Lyon

Abstract: *L'article présente un model théorique pour calculer le coefficient de frottement en roulement à l'interface d'un contact elliptique. La géométrie de contact considéré a été celle d'un contact elliptique général galet-plan. Les résultats numériques obtenus montrent une variation du coefficient de frottement en roulement sur l'aire de contact en fonction du micro-glissement induit par les déformations élastiques.*

51. PRESSURE DISTRIBUTION IN AN ELLIPTICAL ELASTIC-PLASTIC CONTACT BOUNDED BY WAVY SURFACES, STATICALLY LOADED

pp. 427 - 434

by Dorel PRODAN & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: Dans cet travail on présente un algorithme et un programme de calcul pour déterminer la distribution des pressions sur la surface d'un contact elliptique ondulé pour le cas élastique – parfaite plastique, respectivement élastoplastique avec écrouissage cinématique linéaire. Les résultats obtenus seront utilisés après pour la détermination de l'état des contraintes et des déformations dans le massif pour tout les deux cas mentionnés.

52. STRESS AND STRAIN STATES IN AN ELLIPTICAL CONTACT BOUNDED BY WAVY SURFACES, NORMALLY AND TANGENTIALLY LOADED

pp. 435 - 446

by Dorel PRODAN & Delia CERLINĂ

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: Dans cet travail on présente d'abord la théorie qui permet le calcul d'état des contraintes et des déformations dans un demi-espace élastique, c'est à dire la théorie de Boussinesq et de Cerruti. Après, on applique cette théorie dans le cas général d'un contact elliptique (tonneau-plan), la surface du tonneau étant modulée par des ondulations longitudinales et/ou transversales avec diverses amplitudes et avec diverses longueurs d'ondes. Le programme de calcul est réalisé en MATHCAD 6 et il peut être utilisé même dans le cas des surfaces rugueuses réelles. On peut considérer aussi l'effet du chargement tangentiel sur l'état des contraintes et des déformations

53. STRESS AND STRAIN STATES IN AN ELASTIC-PLASTIC ELLIPTICAL CONTACT BOUNDED BY WAVY SURFACES

pp. 447 - 460

by Dorel PRODAN & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: Dans cet travail on présente d'abord la théorie de la plasticité avec ses lois particulières: l'élastoplasticité parfaite (sans écrouissage), écrouissage isotrope, écrouissage cinématique linéaire, respectivement écrouissage cinématique non-linéaire. On présente après, un modèle théorique basé sur la théorie incrémentale de la plasticité. Ce modèle permet la réalisation d'un programme de calcul pour l'évaluation de l'état des contraintes et des déformations dans le massif pour le cas élastoplastique avec écrouissage cinématique linéaire.

54. THE EFFECT OF A SURFACE CIRCULAR DENT UPON PRESSURE DISTRIBUTION

pp. 461 - 464

by Emanuel DIACONESCU & Delia CERLINCĂ

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *Rolling contact fatigue is strongly influenced either by surface defects or by subsurface imperfections. The latter tend to become the major factor influencing contact fatigue. The first step to assess the effect of these defects upon contact fatigue life is to find the pressure distribution in their presence. This paper investigates the pressure riser effect around a circular dent placed centrally in a Hertz circular contact.*

55. THE EFFECT OF A SURFACE CIRCULAR DENT UPON CONTACT STRESSES

pp. 465 - 470

by Delia CERLINCĂ & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *Rolling contact fatigue is strongly influenced either by subsurface imperfections or by surface defects. The latter tend to become the major factor influencing contact fatigue. The second step to assess the effect of these defects upon contact fatigue life is to find after the pressure distribution, the stress state alterations they generate. This paper investigates the stress state effect around a circular dent placed centrally in a Hertz circular contact. The dent affects the stress state only in its immediate neighborhood.*

56. VALIDATION OF REFLECTIVITY AS AN EXPERIMENTAL TOOL IN CONTACT MECHANICS

pp. 471 - 476

by Marilena GLOVNEA & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *The principles of a new method to assess contact area in contact models made of a metallic punch pressed against a thick sapphire window was previously proposed by these authors. This is based on measuring the reflectivity of this model by aid of a laser profilometer. This paper aims to validate this method by investigating the dependence of contact area on load in a circular Hertz contact between a bearing ball and a flat sapphire window. It is found that this method is accurate at medium and high loads but yields higher contact radii than the theory predicts at small and very small loads.*

57. A NEW EXPERIMENTAL TECHNIQUE TO ASSESS THE CONTACT PRESSURE

pp. 477 - 482

by Emanuel DIACONESCU, Marilena GLOVNEA & Liliana FLORIȘTEAN

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *This paper presents a new possible method to assess experimentally contact pressure in real contacts. This consists in covering one of contacting surfaces with a gel, prior to contact closing. Then, the contact is closed and the gel transforms into an amorphous state at applied contact pressure. The refractive index of solidified gel is a function of the pressure acting during phase change. After contact opening, the reflectivity of gel layer is scanned via a laser profilometer. This reflectivity increases with solidifying pressure, thus offering an indication upon former contact pressure. Preliminary results obtained in a circular point contact and a finite length line contact indicate that this method possesses great potential to become a new experimental tool in contact mechanics.*

**58. EXPERIMENTAL INVESTIGATION UPON ROLLING CONTACT FATIGUE
INFLUENCED BY A SURFACE FURROW**

pp. 483 - 486

by Delia CERLINCĂ & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *Experimental investigation upon rolling contact fatigue influenced by a surface furrow is presented.*

**59. CALCULATION OF LOWER SPHERICAL BEARING OF A MCPHERSON SUSPENSION
BY FINITE ELEMENT METHOD**

pp. 487 - 494

by Arthur CAMCIUC

Polytechnic University of Bucharest – Romania

60. THEORETICAL CONSIDERATIONS CONCERNING THE EFFECT OF TYPICAL PARAMETERS DEFINING THE SURFACE STATE UPON FATIGUE BEHAVIOUR OF STEELS

pp. 495 - 506

by Ioan Valentin MARIN, Aurelian VLASE & Gina STOICA

Polytechnic University of Bucharest – Romania

Abstract: *L'étude sur les paramètres qu'ils peut avoir une influence sur les propriété en fatigue des matériaux de construction. Plusieurs aspects sont à considérer pour rendre compte du rôle en fatigue du l'état de surface:*

- *aspect géométrique: l'état de surface d'une pièce, produit par ses conditions de réalisation (usinage, formage), correspond à des irrégularité directement à la tenue à la fatigue. Les mesures de rugosité permettent de quantifier l'état de surface par l'intermédiaire du paramètre rugosité totale. Ce coefficient correspond à la variation entre maximum et minimum absolus enregistrés sur la plage de palpée considérée;*
- *aspect mécanique: la rugosité seule ne permet pas d'appréhender totalement les effets de la mise en oeuvre d'une pièce. En fonction du procédé, un écrouissage superficiel du métal peut se produire qui modifie les propriétés locales du métal dans la zone la plus sollicitée où l'amorçage en fatigue peut se produire. Cet écrouissage s'accompagne généralement de l'apparition d'une champ de contraintes résiduelles, soit de traction, soit de compression. La tenue à la fatigue de la pièces peut dépendre très largement de l'écrouissage et des contraintes résiduelles de l'opération de mise en oeuvre;*
- *aspect métallurgique: la structure du matériau peut être altérée au cours de sa mise en oeuvre; un traitement thermique mal conduit peut produire un phénomène de decarburation superficielle provoquant un adoucissement du métal dans une zone fortement sollicitée; une usinage trop violent peut transformer en surface le métal et modifier ses propriétés d'emploi.*

Les trois aspects sont pris en compte: l'influence de la rugosité, l'influence des contraintes résiduelles et l'influence du durcissement de la surface sur la tenue à la fatigue des matériaux de construction.

61. EXPERIMENTAL STUDIES CONCERNING CYCLIC AND MONOTONOUS HARDENING OF STAINLESS STEELS

pp. 507 - 516

by Ioan Valentin MARIN, Aurelian VLASE & Gina STOICA

Polytechnic University of Bucharest – Romania

Abstract: *La majorité des ruptures de pièces mécanique observées en service correspond à un endommagement par fatigue. Ce type d'endommagement est dû à l'application d'effort cyclique et il peut se produire pour des contraintes nominales appliquées bien inférieurs à la limite d'élasticité du matériau.*

La particularité de ce phénomène reste dans sa nature progressive qui amène très souvent à une rupture brutale de la pièce. Cet article concerne les aspects expérimentales sur la tenue en fatigue de l'acier inoxydable 304L. Deux types d'essais ont été menés:

- *des essais à charge imposée;*
- *des essais à seuil de déplacement imposé et asservissement en charge.*

Les cycles sont réalisés à chargement croissant par palier. Pour chaque palier, les boucles d'hystérésis force - déplacement sont enregistrées.

62. CINEMATIQUE RELATIVE INDUITE A L'INTERFACE D'UN CONTACT DU AU MICRO-GLISSEMENT. I. CONTACTS CIRCULAIRES

pp. 517 - 524

by Luminița IRIMESCU & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *L'article présente des considérations théoriques concernant l'influence des déformations élastiques sur le glissement partiel sur une aire circulaire de contact avec roulement. Des différentes géométries de contact ont été considérées: galet-cylindre, sphère - sphère et sphère – plan. Les résultats montrent qu'il y a des zones de micro glissement dans des différentes situations.*

63. CINEMATIQUE RELATIVE INDUITE A L'INTERFACE D'UN CONTACT DU AU MICRO-GLISSEMENT. II - CONTACTS ELLIPTIQUES

pp. 525 - 532

by Luminița IRIMESCU & Emanuel DIACONESCU

“Stefan cel Mare” University of Suceava - Romania, Department of Applied Mechanics

Abstract: *L'article présente l'analyse théorique de l'influence des conditions de contact sur le glissement partiel sur une aire elliptique de contact avec roulement. Les suivantes géométries de contact ont été considérées: galet - cylindre, galet - plan et sphère – cavité conforme. Les résultats montrent qu'il y a des zones de micro-glissement même dans l'absence du glissement totale.*