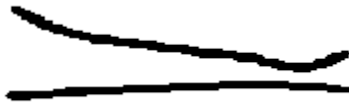


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Hydrodynamic Lubrication

1. THE ADIABATIC ANALYSE OF NARROW HIGH SPEED JOURNAL BEARINGS WITH GEOMETRIC DEFECTS

pp. 1 - 12

by Daniela BUZESCU¹ & Mircea D. PASCOVICI²

¹ INCDT – COMOTI - Bucharest, Romania

² Polytechnic University of Bucharest - Romania, Department of Machine Elements and Tribology

Abstract: This paper presents an analytical investigation of the influence of barrel-type or saddle-type departure from cylindricity on journal bearing performances using a THD analysis. The energy equation is based on Couette flow assumption; thus the energy equation is decoupled from Reynolds equation and solved independently using a narrow journal bearing approximation ($L/D=0.25$; $\epsilon \leq 0.9$) Bearing performances (load carrying capacity, minimum fluid film thickness) are analyzed by assuming that the shaft axis and the bush axis are parallel.

2. MODELISATION THERMOHYDRODYNAMIQUE TRIDIMENSIONNELLE DES PALIERS LISSES PAR ELEMENTS FINIS

pp. 13 - 20

by Philippe MICHAUD, Dominique SOUCHET et Dominique BONNEAU

Laboratoire de Mécanique des Solides, Université de Poitiers, Unité Mixte de Recherche CNRS, UMR 6610, 4, Avenue de Varsovie, 16021 Angoulême Cedex, France.

Abstract: A numerical procedure is developed in order to analyze the « tridimensional Thermohydrodynamic » behaviour of a bearing under static loading. The Reynolds equation, the energy equation in the film and the heat transfer equation in the solids are simultaneous solved using a Newton-Raphson procedure and the finite element modelisation. The numerical procedure developed incorporates a cavitation algorithm based on JFO model, which automatically predicts film rupture and reformation in the bearings. In the present study, the obtained results from this model are compared to experimental results and numerical results from THD 2D model.

3. A QUANTITATIVE EVALUATION OF JOURNAL BEARINGS, LIGHTLY LOADED

pp. 21 - 26

by Mihail IONESCU

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

Abstract: *The calculation of the parameters of hydrodynamic bearings involve the solution of the system consisting of the differential equations of pressure and of the thermal balance equation, to which other equations are added, depending on the desired degree of precision. At present, the calculation is effected by means of numerical methods and the calculus programs are very complicated, time-consuming and, with the exception of the THD solution, rather inaccurate. The international literature of the last two years contains scientific papers which bring again to the fore the analytical solution of the lubrication problem. The paper proposes a new analytical calculus model for to reaching the variation law of film pressures. This model allows for the use of dynamic boundary conditions along the rotation movement, and it can be applied to the quantitative appraisal of radial bearings with small loads.*

4. EFFECTS OF PISTON LATERAL DYNAMICS ON THE TOP RING NON-AXISIMMETRY HYDRODYNAMIC LUBRICATION

pp. 27-34

by Adolfo SENATORE

Department of Mechanical Engineering, University of Salerno – Fisciano (SA), Italy

Abstract: *The lubrication of the piston ring plays a crucial role in the effort toward the reduction of friction losses in internal combustion engine. This paper considers the influence of the piston secondary motions on the friction force acting on the piston rings taking into account the ring approach motion to the cylinder liner by solving the two-dimensional Reynolds equation. This model is applied to the geometry and operating condition of the piston top ring of a spark ignited engine.*

5. TEORETICAL ANALYSYS OF SQUEEZE-FLOW INSIDE NON-CONFORM SPHERE-PLANE CONTACT

pp. 35-40

by Christian RUSSU

Polytechnic University of Bucharest - Romania, Department of Machine Elements and Tribology

Abstract: *Part of a larger activity of theoretical studies considering special cases of squeeze lubrication and using different methods (analytic, semi-analytic, numeric), the work presented in this paper had as purpose to solve a particular problem. The particularities to be mentioned are: radial symmetry, pure squeeze (only normal translation movement, without tangential component), non-conform plan-sphere*

contact geometry, Power Law (Ostwald de Waele) for rheologic behavior. The paper present analytical considerations leading to the equation that define the pressure gradient and some numerical results that allows especially a qualitative comparison between the squeeze process in the parallel circular plate model and our model and between a newtonian fluid and a power law fluid which simulate a pseudo-plastic behavior characteristic to sinovial fluid.

6. ÉTANCHEMENT FRONTAL EXTÉRIEUR AUX IMPULSIONS. LE CALCUL DE LA FORCE AXIALE D'OUVERTURE DE L'INTERFACE D'ÉTANCHEMENT

pp. 41-48

by Marius PUSTAN

Université Technique de Cluj-Napoca, Romania

Abstract: *Nous nous intéressons au calcul de la force axiale d'ouverture de l'interface d'étanchement, dans un système présentant un étanchement frontal extérieur aux impulsions. Les impulsions sont le résultat d'une variation de pression au niveau des chambres exécutées sur la surface frontale du stator de l'étanchement. Suite à ces impulsions, l'anneau du stator subit de faibles perturbations.*

Elastohydrodynamic Lubrication

7. PRESSURE MEASUREMENT IN ENGINE BEARING BY A NEW THIN-FILM SENSOR

pp. 49-60

by Tsuneo SOMEYA¹ & Yuji MIHARA²

¹ University of Tokyo, Japan

² Musashi Institute of Technology, Japan

Abstract: *This paper presents the development of a thin-film pressure sensor and the measurement of oil-film pressure in engine bearings using the sensor. The thin-film piezo-resistive sensor is sputtered onto the sliding surface of the engine bearings. The change of resistance under the pressure is measured by a Wheatstone bridge and recorded. Using calibration curve of the sensor for resistance and pressure, the oil-film pressure in journal bearings of a Diesel engine could be measured successfully. Because of its thin and small size, the thin-film sensor hardly disturbs the measurement object and has high spatial resolution.*

8. TANGENTIAL EFFECTS INVESTIGATION IN EHD LUBRICATED IMPACT. MODERNISED TEST RIG AND NEW EXPERIMENTAL RESULTS

pp. 61-70

by Ilie MUSCĂ

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

Abstract: *A manner to investigate oils shear properties at high pressure based on impact, conceived by this author, was re-used on a computer assisted test rig in order to obtain new experimental results for the T90 EP2 Romanian oil limiting shear property. A good correlation of current and previous results has been found.*

9. THE BEHAVIOUR OF AN ANTI-WEAR ADDITIVE ON DIFFERENT COATINGS IN CONCENTRATED CONTACTS

pp. 71-80

by Romeo Glovnea, Hiroshi FUJITA & Hugh SPIKES

Imperial College London, London, United Kingdom

Abstract: *Anti-wear film thickness and friction coefficients have been measured in elastohydrodynamic contacts for different pairs of surface coatings in the presence of a common antiwear additive, zinc dialkyldithiophosphate. The materials used were, 52100 steel, chromium, and titanium nitride. Comparative tests were carried out using a base stock mineral oil, and a blend of it and ZDDP. It has been found that steel gave the thickest antiwear film, in comparison with titanium nitride and chromium. The film produced on the titanium nitride surface was formed very quickly and, in the same time, even and constant in time. The chromium surface initially generated a film with a thickness similar to that obtained for titanium nitride, which was later removed together with the chromium coating, and allowed the steel underneath to react and form a film typical to this material.*

10. THERMOELASTOHYDRODYNAMIC BEHAVIOUR OF NON-NEWTONIAN DYNAMICALLY LOADED JOURNAL BEARINGS

pp. 81-93

by Aurelian FĂTU A., Mohamed HAJJAM & Dominique BONNEAU

University of Poitiers, France

Abstract: *An efficient method for thermoelastohydrodynamic (TEHD) lubrication journal bearings analysis is presented. Lubrication film temperature is treated as a time-dependent two-dimensional variable, which is averaged over the film thickness. The oil non-Newtonian behavior is included. The non-Newtonian effect is introduced by modifying the viscosity for each point of a 3D numerical film mesh and for each iteration. Using a convenient iterative solution procedure, the converged solutions for lubricant flow and elastic deformation fields are obtained. The algorithm efficiency for studying complex bearing configuration is demonstrated by solving a connecting rod bearing TEHD lubrication problem. It has been proved that the non-Newtonian shear-thinning effect cannot be neglected in an accurate lubrication analysis.*

Biotribology

11. PHOTOELASTIC RESEARCH ON FEMUR EXTREMITIES

pp. 94-102

by Gheorghe FRUNZĂ & Bogdan CIOTINĂ

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

Abstract: *Biomechanical factors of physical load determine a state of stress in skeletal system elements, including the femur. Femur extremity load is significant because it leads to tribological phenomena and processes at biocontact interface, which may yield biomechanical fatigue having pathologic effects. Consequently, the present paper presents femur extremity stress under various contact conditions using photoelastic models.*

12. PARTICULARITIES OF THE PSEUDO-PLASTIC LUBRICATION, WITH APPLICATION TO THE SINOVIAL LIQUID

pp. 103-108

by Alexandru V. RADULESCU

University “POLITEHNICA” Bucharest, ROMANIA

Abstract: *The present paper proposes a new model for lubrication of the hip joint with hyaluronan solutions, considering the squeeze film process of non-Newtonian fluid between rigid spherical surfaces. The rheological model that approximately describes the behavior of the synovial fluid is the power law model. For the considered case, the pressure distribution, the load capacity, the film thickness and the friction coefficient have been determined. The conclusions of the paper offer an explication to the development of the osteoarthritis and to the problems of the arthritic patients.*

13. THE ROLE OF SINOVIAL FLUID RHEOLOGY IN FRICTION OF NATURAL SINOVIAL JOINTS

pp. 109-117

by Florin MUNTEANU & Paul BOTEZ

Faculty of Medical Bioengineering, University of Medicine and Pharmacy „Gr. T. Popa”, Iasi, Romania

Abstract: *The focus of this paper is on the tribological behavior of natural synovial joint. The rheological behavior of synovial fluid is complex and related with distance between articular surfaces. At smaller distance (little than hyaluronic acid molecule diameter) between articular surfaces synovial fluid behavior is biphasic, and at greater distance (greater than hyaluronic acid molecule diameter) between articular surfaces synovial fluid behaviour is newtonian. When the distance between articular surfaces is approximate with hyaluronic acid molecule diameter, synovial fluid is a thixotropic fluid. According with load and motion (for knee), the type of lubrication of natural synovial joints is different: after prolonged stance – boosted lubrication; heel strike – squeeze film combined with weeping lubrication; weight transfer – EHD lubrication; toe off – boundary combined with weeping lubrication; swing – hydrodynamic lubrication.*

14. AN EXPERIMENTAL MODEL FOR ANALYZING THE BIOTRIBOLOGICAL FUNCTION OF HEALTHY ARTICULAR JOINTS

pp. 118-127

by Ana-Maria SFARGHIU, Yves BERTHIER & Marie-Hélène MEURISSE

Laboratoire de Mécanique des Contacts et des Solides, UMR CNRS - INSA de Lyon 5514, France

Abstract: *The real rheological behavior of synovia is highly dependent on the running conditions in articular joints. Complex mechanical and physico-chemical properties of articular cartilage define the boundary conditions for the real dynamics of the synovial fluid; that is why the rheological study should be done in the presence of the two articular cartilages which leads to a complex tribological study. The resolution of the in vivo means of investigation is insufficient to characterize the local tribological mechanisms, in particular at molecular scale. It is thus necessary to define an experimental ex vivo simulation including models of synovia and cartilage. We propose a model of articular contact, made of a gel, a polymeric membrane, and artificial synovia, which respects the mechanical and physical properties of articular cartilage and synovia. This model will allow ex vivo tribological tests aiming to a better understanding of the real tribological mechanisms of a healthy articular joint.*

15. VARIATION OF FRICTION FACTOR THROUGH THE GAIT CYCLE IN AN UHMWPE-CoCrMo HIP ENDOPROSTHESIS

pp. 128-140

by Florin MUNTEANU¹ & Mihai GAFIȚANU²

¹ Faculty of Medical Bioengineering, University of Medicine and Pharmacy „Gr. T. Popa”, Iasi, Romania

² Technical University “Gh. Asachi” Iasi, Romania

Abstract: *The frictional factor of three new bipolar hip prostheses were measured using one hip function simulators designed in Biomechanics Laboratory of Medical Bioengineering Faculty. Hip simulator respect physiological condition (variable load, variable motion). The friction factor value for dry regime through the gait cycle was found variable.*

16. INFLUENCE OF WEAR DEBRIS IN JOINT REPLACEMENTS

pp. 141-158

by Paul BOTEZ, Adrian CARTALEANU & Florin MUNTEANU

Faculty of Medical Bioengineering, University of Medicine and Pharmacy „Gr. T. Popa”, Iasi, Romania

Abstract: *Progressive generation of particulate wear debris has been widely observed in joint replacements after several decades of clinical experience. Most of prosthetic materials are usually well tolerated in the bulk form. Nevertheless, there is a continuous release of particulate debris generated from cemented fixation and wear of prosthetic surfaces, whether plastic, metallic or ceramic, which highly increases the contact area between the implanted material and the biological environment. The widespread dissemination of debris and the large surface area produce a potentially toxic effect on the local bone metabolism, contributing to the early failure of implant. Particulate debris trigger a complex biological response consisting in macrophages recruitment, phagocytosis, release of inflammatory mediators and proliferation of fibroblastic pseudomembranes which induce progressive bone resorption (osteolysis). Initially attributed to cement debris, periprosthetic osteolysis was also observed in cementless implants. This process is supposed to occur earlier, more frequently and accelerated in such implants, leading to early revision procedures. Polyethylene, metals and ceramics are the common materials used in both cemented and cementless systems. Such particles have been identified in retrieved membranes from the bone - implant interfaces and osteolytic cavities in failed arthroplasties during revision operations. Efforts of biomaterial scientists, tribologists, cell biologists and orthopaedic surgeons should be combined to improve the design and biomaterials of prosthetic joints. Continuous research must be made to minimize wear and friction, as well as corrosion, with the aim of decreasing the production of particulate debris from articular and nonarticular interfaces. The longevity of joint arthroplasties should be improved with decreased generation of this debris.*

Microtribology

17. L'INFLUENCE DE LA MICROTOPOGRAPHIE DES SURFACES SUR LA DEFORMATION PLASTIQUE POUR UN CONTACT CIRCULAIRE LIMITE DES SURFACES RUGUEUSES REELES

pp. 159-168

by Dorel PRODAN & E.N. DIACONESCU

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

Abstract: *We recommend to investigate the pressure distribution and the stress state in a real elasto-plastic circular contact, bearing balls of three different degrees of surface finishing were used. These were pressed against a polished flat surface made of a softer steel. The surface microtopography measured in each case by a laser profilometry was introduced in a numerical program developed to evaluate the pressure distribution, stress state and residual deformations for an elasto-plastic material with non-linear hardening. The dimension of calculated contact plastic deformations compare favorably with those experimentally by aid of a laser profilometer..*

18. L'INFLUENCE CUMULATIVE DE LA MICROTOPOGRAPHIE, DE LA DURETE ET DE LA CHARGEMENT SUR LA DEFORMATION PLASTIQUE POUR UN CONTACT CIRCULAIRE LIMITE DES SURFACES RUGUEUSES REELES

pp. 169-173

by Dorel PRODAN & E.N. DIACONESCU

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

Abstract: *Dans ce travail on essaie la distinction des influences plusieurs facteurs qui détermine la qualité du couche superficielle: microtopographie et dureté. Par des graphes tridimensionnels et diagrammes ternaires on a mis en évidence leur influence cumulative en fonction de la charge. Pour une certaine dimension d'une sphère avec trois degrés de finition en contact avec une éprouvette plane ayant trois duretés différentes on a applique des chargements différente. Les déformations plastiques ont été analyse par UBM (profilométrie laser) et les résultats ont été représenté par diagrammes spatiales et diagrammes ternaires avec l'aide du programme STATISTICA.*

19. AN ANALYTICAL AND NUMERICAL APPROACH OF LOAD CARRYING CAPACITY FOR PARTIALLY TEXTURED SLIDERS

pp. 174-181

by Mircea PASCOVICI & Victor MARIAN

Department of Machine Elements and Tribology, University Politehnica of Bucharest – Bucharest, Romania

Abstract: *Partially textured sliders generate a load carrying capacity with an effect similar to stepped bearings. The present paper presents a theoretical investigation of a partially textured slider using an analytical and a numerical method. The pressure distribution is calculated analytically and numerically and the performance of the bearing is evaluated varying different parameters: number of dimples, dimple density, dimple height, textured fraction of the slider. The optimal configuration for the slider is determined in order to produce maximal load carrying capacity.*

20. FRICTION IN A LOW-LOAD SLIDING CONTACT

pp. 182-193

by JianHuei CHOO, Romeo GLOVNEA, Andrew FORREST & Hugh SPIKES

Imperial College London, London, United Kingdom

Abstract: *In this research, a novel tribometer capable of measuring low friction and load has been employed to measure friction in a pure sliding contact in hydrodynamic lubrication conditions. The tribometer was custom-built at the Tribology Section, Imperial College specifically for measuring friction at loads usually found in Microelectromechanical Systems (MEMS), to allow the authors to investigate the feasibility of using liquid slip for the lubrication of MEMS. The work described here represents the first stage of research undertaken by the authors to ascertain the behaviour of the tribometer, and to detect the presence of liquid slip, if any, in a lubricated low-load contact between two untreated glass surfaces. Experiments were conducted for both line and point contacts at sliding speeds ranging from 200 mm/s up to 3 m/s, and loads less than 0.5 N. The ability to measure friction at such low loads complements existing tribological techniques and instruments and extends our understanding of the interaction between surfaces at ever decreasing contact forces.*

by Dumitru OLARU¹, Peter LORENZ² & Dietmar RUDY³

¹Technical University "Gh. Asachi" of Iasi, Romania

²Hochschule fur Technik und Wirtschaft des Saarlandes HTW, Germany,

³INA Lineartechnik oHG, Homburg, Germany

Abstract: *A complex analytical model to evaluate the friction losses in a micro linear ball bearing has been developed. The model includes following losses sources: pivoting motion between ball and races, elastic resistance in rolling of the ball over the races, hydrodynamic effects in ball-races and the losses in the ball-ball contacts. Both adhesion between balls and the races and capillary effects in the ball- ball contacts was considered. To validate the model, the numerical results was performed for a micro linear ball bearing studied experimental by [1]. The numerical results are in the same range of values with experimental results.*

Contact Mechanics

22. NUMERICAL CONSIDERATIONS UPON CALCULUS OF ELEMENTS OF NORMAL ELASTIC CONTACT

pp. 208-219

by Dorin GRĂDINARU

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

Abstract: Several methods to build influence coefficients in numerical contact problems are compared. The performed analysis takes into account two types of mesh, two methods of influence coefficients calculation, two numerical models, eight methods of solving the systems of pressure equations and solution refining. The results found by various numerical methods agree well with published data.

23. ELASTIC CONTACT OF REVOLUTION BODIES BOUNDED BY HIGH ORDER SURFACES

pp. 220-233

by Emanuel DIACONESCU & Marilena GLOVNEA

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

Abstract: Hertz theory is restricted to surfaces expressed by second order polynomials. High order, revolution surfaces may occur in electrical contacts or micro-contacts or in miniature thrust bearings. This paper advances general formulae for contacts between such bounding surfaces which yield known results in the case of circular Hertz contacts. Then, a contact between fourth order surfaces is analyzed and an amelioration procedure is formulated.

24. NUMERICAL ANALYSIS OF FINITE LENGTH LINE ELASTIC CONTACTS

pp. 234-251

by Dorin GRĂDINARU

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

Abstract: By using a numerical method developed for analysis of elastic contacts, comparison is made between various methods of generatrix crowning in finite length line contacts. The results obtained for generatrix crowning by a single, by three and by five circle arcs agree well with published data.

25. ANALYTICAL AND FEM INVESTIGATIONS OF AN ELASTIC PLANE CONTAINING AN ELLIPTICAL HOLE

pp. 252-258

by Stelian ALACI, Emanuel DIACONESCU & Ilie MUSCĂ

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

Abstract: *The paper presents the effect of an elliptical hole in an elastic half-space loaded at infinity with various forces. The variations of hoop stresses from the border of the hole for various eccentricities and loads are shown comparatively. The effect of concentration due to the hole is denoted and its increasing as the hole extends is emphasized.*

26. THREE-DIMENSIONAL ELASTIC-PLASTIC ROLLING CONTACT ANALYSIS: A COMBINED KINEMATIC AND ISOTROPIC WORK-HARDENING MATERIAL MODEL

pp. 259-266

by Gabriel POPESCU

„Gh. Asachi” Technical University of Iasi, Romania

Abstract: *Fatigue life of rolling bearings is strongly dependent on elastic-plastic material properties. A detailed description of material behaviour can be obtained in case of through-hardened steel by performing monotonic or half-compressive tests. Through-hardened bearing steel with high residual austenite content was modelled as combined isotropic and kinematic material with non-linear hardening. Parameters describing the influence of retained austenite are modelled by using the Armstrong-Frederick non-linear law. In the elastic-plastic analysis, Prandtl-Reuss equations were used in association with von Mises flow rule. Cyclic evaluation of plastic strains is carried out, until shakedown is reached in both rolling elements.*

27. SUPERPOSITION PRINCIPLE IN THE CASE OF CONTACT BETWEEN A RIGID PARABOLOID AND A MAXWELL LINEAR VISCOELASTIC HALF-SPACE

pp. 267-274

by Florina Carmen CIORNEI & Emanuel DIACONESCU

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

Abstract: *Applying the theory developed by Ting, the contact of Hertz type between a rigid paraboloid and a Maxwell viscoelastic half-space subjected to variable loading is studied. Using a proposed methodology, the contact radius is deduced for different types of dynamic loading. For forces expressed as linear combinations of simple functions, the superposition principle can be applied in obtaining the expression of contact radius.*

28. CONTACT PRESSURE BETWEEN A RIGID PARABOLOID AND A MAXWELL HALF-SPACE SUBJECTED TO LINEARLY INCREASING LOADING

pp. 275-282

by Florina Carmen CIORNEI & Emanuel DIACONESCU

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

Abstract: *The contact problem between a linear viscoelastic half-space and a rigid axisymmetric probe was solved by Ting, [1]. Applying the theory in the case of a rigid paraboloid and a Maxwell half-space, the contact elements were deduced for different dynamic loads, [2]. The contact pressure in the case of linearly increasing force is studied in the present paper. The influence of material characteristics is emphasised.*

29. ETUDE PHOTOELASTIQUE PRELIMINAIRE POUR UN CONTACT EN ROULEMENT

pp. 283-293

by Stelian ALACI, Emanuel DIACONESCU, Gheorghe FRUNZĂ & Luminita IRIMESCU

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

Abstract: *The paper presents a rig for rolling contact research. It tries to emphasize the hysteresis for rolling elastic contact. For stress analyses photoelastic method is used. Preliminary results are presented.*

30. DETERMINATION OF COLLISION COEFFICIENT FOR COLLINEAR IMPACT OF TWO SPHERES

pp. 294-301

by Stelian ALACI, Emanuel DIACONESCU & Florina Carmen CIORNEI

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

Abstract: *The paper presents a method and a test rig used to measure the restitution coefficient in the case of central collision of two spheres. The principle of the work is based on the fact that the period of a mathematical pendulum depends on angular amplitude. Experimental tests carried out on the proposed test rig lead to an actual value of restitution coefficient.*

31. A FEM MODEL FOR ADHESIVE JOINTS TAKING INTO ACCOUNT THE INTERFACE TOPOGRAPHY

pp. 302-307

by Sorin CIORTAN, Lorena DELEANU, Minodora RÎPĂ

University "Dunărea de Jos" of Galați, Romania

Abstract: *This paper presents a comparison between the stress state of a smooth ideal lap joint and one having the adherent surfaces characterised by a profile, using finite element method. The results pointed out local peaks of the stresses even for a model having 1mm as joint width. These local maximum stresses will certainly influence the durability of the bonded joint and could be introduced in simplified calculus by a coefficient related to the profile parameters.*

Friction

32. DETERMINATION EXPERIMENTALE DU COEFFICIENT DE FROTTEMENT A SEC OU EN PRESENCE DE LUBRIFIANT

pp. 308-314

by T. T. H. TRAN, T. ZEGHLOUL, D. BONNEAU & B. VILLECHAISE

Laboratoire de Mécanique des Solides - Université de Poitiers, UMR CNRS 6610 IUT Angoulême, 4 Avenue de Varsovie, 16 021 Angoulême Cedex.

Abstract: *This experimental study belongs to the scope of a modeling of interactions between the different bodies of a connecting rod big end bearing. We propose to determine the value of the friction coefficient for the mating surface between the body and the cap of connecting rod. We are in the presence of a contact in lubrication or lack (dry contact). The results indicate the evolution of the charge tangential / normal load ratio for different situations of contact and loading. These ratios depend significantly on the presence or not of the lubricant and on the intensity of the normal load no matter the. However, for a given loading velocity, we note little influence of the loading process on the obtained results.*

33. SIMULATION NUMERIQUE D'UN CONTACT GLISSANT: ONDES DE CONTRAINTES

pp. 315-319

by T. ZEGHLOUL & B. VILLECHAISE

Laboratoire de Mécanique des Solides - Université de Poitiers, UMR CNRS 6610 IUT Angoulême, 4 Avenue de Varsovie, 16 021 Angoulême Cedex.

Abstract: *Frictional contact is often accompanied by instability phenomena. The numerical model presented in this paper enabled the analysis of the frictional contact between a deformable rectangular polyurethane slab (photoelastic material) and a rigid plane surface. The slab is first pressed against a rigid surface with a prescribed normal displacement. Then an increasing tangential load is applied. We propose a semi-analytical modelling of the stress waves which occur in this type of contact.*

34. SOME ISSUES OF THE RESEARCH ON THE FRICTION COEFFICIENT IN THE PRECESSIONAL GEARING BY PLASTIC MASS TOOTH WHEELS

pp. 320-327

by Ion BOSTAN, Valeriu DULGHERU & Ion BODNARIUC

Universitatea Tehnica a Moldovei, Republica Moldova

Abstract: *The qualitative indices of mechanical transmissions by means of gearing are determined mainly by the power losses in gearing. In this work the mathematic model for the calculation of sliding speed of the precessional gearing is described. As well, the results of a series of experimental research on the determination of the sliding coefficient from the kinematic precessional gearing with various sliding speeds, lubrication regimes and powers that act in the gearing are presented.*

35. A METHOD OF EVALUATION OF ELASTIC HYSTERESIS LOSSES IN ROLLING CONTACT

pp. 328-332

by Luminita IRIMESCU¹, Emanuel DIACONESCU¹, Yves BERTHIER² & Ilie MUSCA¹

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

² INSA de Lyon, France

Abstract: *The paper presents a new method of hysteresis loss evaluation in normally loaded rolling contacts using collision experiments. In a rolling contact, a typical element passes through a cycle of reversed shear similar to the two phases of compression and rebound existing in a collision. This analogy leads to the idea of studying hysteresis loss in rolling through energy loss in collision experiments. The energy dissipated by elastic hysteresis in a sphere-sphere collision is measured, obtaining a linear*

dependence with contact pressure. By extrapolation of experimental values, the corresponding function is obtained. Assuming the linear dependence of hysteresis losses on volume of stressed material, a relation between the energy loss in rolling and that in collision is found.

36. FRICTION IN BALL SCREWS SYSTEMS

pp. 333-344

by Dumitru N. OLARU¹, Vasile PUIU² & George V. PUIU²

¹ Dept. of Machine Design and Mechatronics, Technical University "Gh. Asachi" of Iasi, Iasi, Romania

² Dept. of Mechanical Engineering, University of Bacau, Bacau, Romania

Abstract: A new model to estimate all friction losses between the balls and the circular – arch grooves races (two contact points) from screw and nut has been developed. Based on the equilibrium of the forces and moments acting on the ball, the sliding forces between ball and both screw and nut races are determined without an integrating of the shear stress on contact ellipses. The sliding forces include the rolling forces on the two contacts, the friction moments due to the races curvature, the elastic resistance moments in ball-races contacts, the contact force between the balls and the friction moment between the balls. The program was adapted for a ball – screw system and influence of the speed and load on total friction torque was investigated. The efficiency of the system was computed and good agreement with the literature results was obtained.

37. OIL RING FRICTION LOSS SIMULATION CONSIDERING THE MIXED LUBRICATION REGIME

pp. 345-352

by Adolfo SENATORE¹ & Sorin CIORTAN²

¹ Department of Mechanical Engineering University of Salerno – Fisciano (SA), Italy

² Department of Mechanical Engineering, "Dunarea de Jos" University of Galati, Romania

Abstract: An important portion of the total power loss in a modern automotive engine is due to piston ring/cylinder bore friction. This paper introduces the results of simulations about the friction interaction of the oil ring of a SI engine performed taking into account the mixed lubrication regime. The friction coefficient calculations show a sensible improvement of this crucial parameter whit low-roughness surfaces. The effects of engine speed, radial tension, surface roughness and ring shape are shown.

Wear

38. RELOCATION TECHNIQUE FOR PROFILOMETRIC STUDIES IN WEAR EXPERIMENTS

pp. 353-360

by Minodora RÂPĂ, Lorena DELEANU & Constantin SPÂNU

University "Dunărea de Jos" of Galați, Romania

Abstract: *The paper presents a methodology for studying the surface microgeometry based on the relocation technique. The relocation technique offers more accurate information of the changes taking place in the topography of the superficial layer. Using information about unworn and worn digital profiles, both recorded on the same generatrix of the wear tested roller, two methods for wear evaluation are presented: linear wear estimation by simulating the profile wearing and estimation of the volume wear. Measuring changes of the profiles by relocation techniques could give a better evaluation of the wear process.*

39. SOME EXPERIMENTAL RESULTS ON WEAR OF UHMWPE IN THE PRESENCE OF AN ABRASIVE SLURRY

pp. 361-365

by Tiberiu LAURIAN & Andrei TUDOR

Polytechnic University of Bucharest, Romania

Abstract: *Ultra High Molecular Weight Polyethylene (UHMWPE) has been successfully used as bearing material in total joint replacements for many decades. The aim of this study was to assess the wear performance of UHMWPE in third body abrasive conditions similar or not to those encountered in human joint replacements. Abrasive wear tests are capable of providing some measure of the mechanical properties of a material surface. There are many variable parameters associated with the micro-abrasion test such as applied load, abrasive type, abrasive concentration, ball type, etc [1]. This study will focus on how sterilization factors such as irradiation dose and environment affect the wear rate of UHMWPE.*

40. PRELIMINARY ANALYSIS OF THE DRIVING MECHANISMS FOR SUPERFICIAL TRIBOLOGICAL TRANSFORMATIONS (STT): EXPERIMENTATION AND MODELLING IN THE CASE OF PURE IRON

pp. 366-383

by A. Hachem Haj mourad, Yves Berthier, Magali Busquet & Laurent Baillet

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Abstract: *Superficial Tribological Transformations (or STT) are usually the less damaging response of materials to tribological conditions by producing the proper solid third body for safe behaviour of 'dry' contacts. As a consequence, one solution to control wear is to control STT's formation. The main objectives of this work are to produce STT (i) in more controlled mechanical conditions than in a contact and (ii) if possible, in a volume which is more important and finally to follow the STT's formation to identify their driving mechanisms. A Bridgman Anvil Apparatus is used to shear by rotation pure iron cylindrical samples under a quasi-hydrostatic pressure of 1 to 3 GPa. Two STT layers are observed to appear after about 240° of anvil rotation within the 'skins' of the sample (i.e. the first 20 µm below the surface). The sample structural evolution is analysed as a function of measured global parameters: the torque (C), the hydrostatic pressure (Ph), sliding (S) and sample depth (h). This first experimental analysis is coupled with finite element analysis to calculate sample local sollicitations. Modelling allows to better identify local different driving mechanisms that control experiments: volume shearing, material work hardening, sliding at the interfaces. The experimentally observed STT areas are directly correlated to a specific calculated behavior of the sample 'skin'.*

41. STUDY OF THE BEHAVIOUR IN FRETTING OF A STEEL /POLYCARBONATE COUPLE USING A COMPLETE FACTORIAL EXPERIMENT METHOD

pp. 384-394

by Adelina HAN^{1,2}, Gianni PILLON¹, Bernard VANNES³

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Abstract: *Le frottement et l'usure qui sont les principales causes de la perte d'énergie donc des performances des systèmes mécaniques, restent toujours des thèmes majeurs de recherche. La dégradation des surfaces des premiers corps en contact nécessite une approche pluridisciplinaire faisant appel aux notions de mécanique, de matériaux, de physico-chimie. Les difficultés rencontrées pour prédire l'usure et pour sélectionner des couples de matériaux résultent du fait que le frottement et l'usure ne sont pas directement des propriétés intrinsèques de matériaux et que les sollicitations du*

système tribologique sont en général complexes. Une approche statistique pour l'étude du comportement d'un couple de contact permet une caractérisation plus globale des processus et des phénomènes qui interviennent.

42. CONTACT TEMPERATURE IN A FRETTING CONTACT

pp. 395-402

by A. TUDOR¹, M. M. KHONSARI²

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Abstract: *Friction mechanisms for fretting contacts are the cause for the surface temperature. The determination of the sliding velocity is of primary importance in describing the thermal conditions in a contact. The tangential displacement for a ball- flat contact was expressed by assuming Mindlin hypotheses for an elastic ball on flat contact. The present paper argues that plastic deformation in the contact zone may contribute to relative displacement and to thermal heat flux. Temperatures in the fretting contact can be obtained by the integrating the fundamental solution of conduction. The integral function is solved in dimensionless form for divers parameters of fretting phenomena (friction coefficient, normal load and frequency).*

43. BEARINGS SCUFFING FAILURE MONITORING BY VIRTUAL INSTRUMENTATION

pp. 403-408

by Carmen BUJOREANU, Spiridon CRETU

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Abstract: *Scuffing diagnose of rolling element bearings can be made by the analysis of the bearing friction forces which are the most sensitive indicator of bearing defects. Such analysis is possible only when an adequate model of the monitored process is known. We have studied the interdependence between the Kinematics, dynamic, lubrication and friction phenomena realised in bearing's rolling contacts subjected to an important sliding. As consequence, we elaborate an original algorithm and computer code leading to scuffing criterion ($\mu \cdot p \cdot V^{0.8}$). The evidence of scuffing onset is a sudden increase of friction force. Data acquisition and transducers signal processing were realised using NI-DAQ board and LabVIEW 5.1 soft. A virtual instrument with two channels readings monitoring the friction force and the braking torque was created.*

44. TEMPERATURE - A BEARING SCUFFING FAILURE CRITERION

pp. 409-414

by Carmen BUJOREANU, Spiridon CRETU

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Abstract: *Scuffing is a complex phenomenon of severe adhesive wear generated under particular combinations including contact pressure, lubrication, speed and friction. Scuffing involves the sudden collapse of the lubricant film and is generally regarded as resulting from thermal phenomena. Under particular combinations including contact pressure, lubrication, speed and friction, a critical temperature is reached in the vicinity of the contact. At this temperature, the breakdown film with local welding or adhesion of the contacting surfaces can appear. The paper presents a temperature distribution model for ball bearings contacts related to the scuffing risk. The own experimental and theoretical results are in good agreement with the literature.*

45. THEORETICAL MODEL FOR GENERAL ROLLING CONTACT FATIGUE

pp. 415-419

by Delia-Aurora CERLINCĂ & Emanuel DIACONESCU

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Abstract: *Datorită interacțiunii simultane a unui număr mare de factori, oboseala de contact este un fenomen extrem de complicat. După cum se știe, fenomenul de oboseală de contact poate fi inițiat în adâncime, pe suprafață sau, simultan, în adâncime și pe suprafață. Prin urmare, lucrarea propune un model teoretic general pentru oboseala de contact, propunându-se un model de tip Lundberg – Palmgren pentru evaluarea durabilității de inițiere atât pe suprafață cât și în adâncime, și legea lui Paris pentru evaluarea durabilității de propagare a fisurii.*