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Hydrodinamics

from a bulk energy balance. The results are compared with similar results, obtained using a non-isothermal 1D-TEHD previously published by the same authors.

6. A SOFTWARE TOOL FOR THERMO-ELASTO-HYDRODYNAMIC ANALYSIS OF THRUST BEARINGS

by Andrei MINCULESCU[1], Traian CICONE[2] & Michel FILLON[3]

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***Abstract**: Pressure and temperature induced deformations, although small, can be at the origin of fluid film forming, in sliders with nominal flat and parallel surfaces. A realistic analysis of such configurations must be done using complex, thermo-elasto-hydrodynamic (TEHD) models that cannot be solved using a single commercial software tool. Therefore, specific computer codes must be developed. The present paper presents a software tool developed for TEHD analysis of elastic sliders typically used in thrust bearings. This Thrust Bearing Analysis (TBA) software couples two solvers: a finite element (FE) module to solve for pad deflections and a flow module, for pressure and temperature distribution in the film as well as heat transfer in the pad. The latter consists of an iterative solution of decoupled Reynolds and energy equations, based on a first order finite differences scheme (FD).*

7. ETANCHEITES FRONTALES HYDRODYNAMIQUES

by Nicolae POPA

Université de Pitesti, Romania

***Abstract**: La définition et réalisation de la précision géométrique à l'étanchéité primaire cause des grands problèmes technologiques. Dans le contact hertzien d'une bille sur un plan d'exemplaire, l'épaisseur du film peut être très petite (< 1 µm), mais la géométrie est connue : une sphère – un plan. Au contraire, dans les contacts de surfaces normales (palier, guidage etc), la précision de positionnement est satisfaite même dans un ordre de dimension (1/1000 … 1/10 mm) de l'épaisseur du film. Mais pour un contact de surfaces de type étanchéité primaire, l'épaisseur du film est de l'ordre 1-2 µm. Elle est de même ordre de dimension que la précision géométrique du plan, liée des imperfections de forme et positionnement relative des deux surfaces. Cet étude met en évidence la complexité du contact HD aux étanchéités frontales et permet voir que certaines positionnements (qui probablement existent dans les montages industrielles) créent une portance HD suffisante afin de permettre un fonctionnement satisfaisant.*

Lubricant Rheology

by Ilie MUSCA

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***Abstract**: The paper presents a comparative analysis of inclined impact tests results in dry and lubricated conditions obtained on an original test rig built to evaluate the tangential effects that occur in the oblique impact between a free falling ball and other surface. This evaluation is based on kinematics parameters evaluation before and after impact. Mean oil shear stress and global sliding friction coefficient values are presented. A good similarity of dry and lubricated contact behaviour can be observed. This similarity reveals a solid like behaviour of lubricant during impact.*

Contact Mechanics

by Gabriel POPESCU

Technical University "Gh. Asachi" Iasi, Romania

***Abstract**: A semi-analytical three-dimensional elastic-plastic over-rolling solution is used to evaluate the plastic strains and ratchetting phenomena. Central to this plastic contact formulation is the incremental approach to deal with non-linear material behavior. The Prandtl-Reuss constitutive equations in conjunction with Huber-Mises-Hencky yield criterion and Ramberg-Osgood strain-hardening relationships are applied to describe the plastic behavior of common hardened bearing steel. The model was extended to include the tangential force in the rolling direction, assumed to be proportional to the hertzian contact pressure. Comparisons of three-dimensional pure rolling and rolling/sliding contact results were provided to elucidate the differences in residual stresses and ratchetting behaviour in case of kinematic and work-hardening materials.*

surface deformations in both cases. It is found that the deformed surface of the half-space does not comply with the flat front surface of the punch in the case of a constant friction coefficient, whereas a perfect agreement arises when a constant friction shear stress is assumed. This suggests that a constant shear stress governs the tangential interaction in conformal dry contacts.

16. STRESS STATE IN CERRUTI'S PLANE PROBLEM FOR AN ELASTIC HALF-PLANE WITH A CIRCULAR HOLE

by Stelian ALACI[1], Emanuel DIACONESCU[1] & Cristinel MARES[2]

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[2] Brunel University Uxbridge, United Kingdom

***Abstract**: The paper extends a series of researches upon stress state and concentrator effect of circular holes from an elastic half-plane under different tensions. Some theoretical results of the authors are surveyed. Photo-elastic experimental tests are carried out to validate the theoretical results.*

17. PRELIMINARY EXPERIMENTAL INVESTIGATIONS UPON JUNCTION GROWTH UNDER TANGENTIAL LOADING

by Cornel SUCIU & Vasile COMORITAN

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

***Abstract**: When the contact between two bodies is under a normal load, the contact area is a single circular region. If a tangential loading is applied, the size of the contact area increases considerably before macroscopic sliding takes place. This phenomenon is known as "junction growth". As the hypothesis of junction growth has not yet been experimentally verified for harder materials, as steel and sapphire are, the present paper makes an attempt to verify this phenomenon, by using visualization and measurement of contact area by reflectivity.*

Friction and Wear

18. SURFACE HEATING IN BALL BEARINGS CONTACTS

pp. 134-139

by Carmen BUJOREANU[1], Spiridon CRETU[1] & Daniel Nèlias[2]

[1] Technical University ''Gh. Asachi'' of Iasi, Romania

[2]INSA Lyon, France

Abstract: *When the contact between two bodies is under a normal load, the contact area is a single circular region. If a tangential loading is applied, the size of the contact area increases considerably before macroscopic sliding takes place. This phenomenon is known as "junction growth". As the hypothesis of junction growth has not yet been experimentally verified for harder materials, as steel and sapphire are, the present paper makes an attempt to verify this phenomenon, by using visualization and measurement of contact area by reflectivity.*

19. COMPORTEMENT TRIBOLOGIQUE D'UNE SOURFACE DE POLYCARBONATE TEXTUREE PAR FAISCEAU LASER

pp. 146-152

by Adelina HAN[1], Gianni PILLON[2], Alexandru NICHICI[1] & Bernard VANNES[3]

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[2]Université de Bourgogne, Laboratoire LTm - EA 2976,France

[3]Ecole Centrale de Lyon, Laboratoire LTDS – UMR 5513, France

Abstract: *The paper presents a relatively new solution of improving the tribological behavior of the steel-polycarbonate couple, by means of material removal. This solution consists of realizing a pattern of parallel grooves on the polycarbonate surface with a laser beam.*

by Dumitru OLARU[1], Gheorghe PRISACARU[1] & Peter LORENZ[2]

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[2] Hochschule fur Technik und Wirtshaft des Saarlandes HTW, Germany,

***Abstract**: The authors developed a theoretical model and an experimental procedure to evaluate the rolling friction coefficient in a micro rolling tribosystem. The proposed procedure is based on integration of the free oscillations equations of a micro ball on a spherical surface. Based on the number and amplitude of the ball oscillations experimentally determined, was evaluated the rolling friction coefficient. Was evidenced also, the influence of the atmospheric condensed water on the rolling friction coefficient at the level of micro rolling tribosystems.*

by Rong FU, Baoyun SONG, Fei GAO & Qingjun YU

Department of Material Science and Engineering, Dalian Jiaotong University, Dalian, China

***Abstract**: Copper-graphite composites were fabricated through powder metallurgy technique. The performance of the composites in friction and wear was tested on a friction tester. The formation and development of third bodies during the friction were observed step by step. The results demonstrate that the morphological features of the third bodies affect the friction coefficient and wear rate. In pure copper, the third bodies are strongly adhesive, resulting in drastic oscillation in friction coefficient. As the content of graphite in the composite increases, the third bodies made of graphite become predominant. The presence of graphite prevents the adhesion of the materials, and hence lowers and stabilizes the friction coefficient and wear rate. Microstructural observations of the composite friction surfaces reveal that the third bodies undergo a particle formation and accumulation process and exist as particulates and compact zones. The compact zone is also the result of nucleation and growth process.*

22. EFFECT OF FRICTION MODES ON FRICTION PROPERTIES OF Cu-SiO_2 COMPOSITES

by Fei GAO[1], Rong FU[1], Baoyun SONG[1] & Yves BERTHIER[2]

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[2]*Laboratoire de Mécanique des Contacts et des Solides Institut National des Sciences Appliquées de Lyon, Lyon, France*

***Abstract**: The effects of content and granularity of SiO_2 on friction and wear performance of copper matrix composites depend on friction conditions. Cu-SiO_2 composites are prepared through powder metallurgy for this study. The effects of SiO_2 content, SiO_2 granularity and different friction modes on the friction performance of the materials were studied with friction speed of 1.6 ~ 47.1 m/s. The results show that the friction coefficient and wear rate increase with increasing SiO_2 content, the SiO_2 granularity has negligible effect, and the friction mode affects the friction and wear considerably as a result of its influence on the configuration of the third bodies. The third bodies formed in high speed friction are continuous and compact, leading to reduced wear rate and decreased fluctuation in the friction coefficient with the change in friction speed.*

23. ASPECTS OF ANALYTICAL EVALUATION OF INTERFACIAL FRICTION

by Luminiţa Irimescu[1], Florina Ciornei[1], Emanuel Diaconescu[1] & Yves Berthier[2]

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[2]Laboratoire de Mécanique des Contacts et des Solides Institut National des Sciences Appliquées de Lyon, Lyon, France

***Abstract**: Afin d'évaluer le frottement à l'interface, on a étudié comparativement les contacts sphère – plan et galet – plan, pour la même distribution des contraintes de contact. Les essais expérimentaux ont donné une bonne validation qualitative du modèle analytique proposée pour le microglissement à l'interface d'un contact élastique en roulement.*

Biotribology

26. A METHOD BASED ON VIBRATION ANALYSIS TO ASSESS THE STABILITY OF PARTIALLY CEMENTED HIP STEMS: A CLINICAL STUDY

by Leonard PASTRAV, Siegfried JAECQUES, Michiel MULIER & Georges VAN DER PERRE

K.U.Leuven, Belgium

***Abstract**: A change of the boundary conditions of an implant can be indicated by an alteration of the vibrational behaviour of the implant-bone structure. In the case of partially cemented hip stems the contact conditions vary between different situations: uncemented stem and cemented stem with the cement in different polymerisation stages. A pilot study was set up to study the feasibility of monitoring the curing of poly-methyl methacrylate (PMMA) bone cement in situ by vibration analysis during a total hip replacement (THR) procedure. The frequency response function (FRF) evolution reflected the changes at the bone-implant interface due to the presence of the cement.*

27. GEOMETRICAL CONSIDERATIONS RELEVANT TO THE INITIAL STABILITY OF HIP PROSTHESES.

by Luc LABEY, Siegfried JAECQUES, Cezar PASTRAV, Frederik GELAUDE, Michiel MULIER & Georges VAN DER PERRE

K.U.Leuven, Belgium

***Abstract**: The stability of hip prostheses is one of the determining factors for their long-term performance. Certainly in the case of cementless implants, where the prosthesis stem is only fixed to the bone by a so-called interference fit, sufficient stability is hard to achieve. Peroperatively manufactured custom-made stems, which give optimal fit and fill of the intramedullary canal, might resist the daily loads on the hip better than standard stems. However, a large variety of stem geometries can be expected with this technique. We used the principle of virtual work and a straightforward mechanical model to obtain algebraic formulas to estimate the role of the geometry of custom-made hip stems in their initial stability. The initial stability of 10 custom-made hip stems was estimated and compared with the stability of the Charnley and 3M Capital hips.*

biomechanical fatigue microcracks, which manifests itself finally on a very small area from the teeth interface. The cracks can be nucleated on the surface, on the subsurface or on both, depending on the quality of the dental materials, the restorations accuracy, the physiological or pathological conditions and also on the initial stresses and the interface. The groups of stresses which act upon a nucleate crack from the dental biocontact surface are contact, interface and initial stresses. If in the natural biocontacts the tribological processes are in conventional conditions under the control of the biosystem in which are integrated, in the biocontacts between a natural material and an artificial one there should be a different approach, which constitutes the subject of this paper.

31. ANALYSIS OF A BIOMECHANICAL FACTOR AFFECTING TYPE I ENDOLEAKS IN A STENTED ABDOMINAL AORTIC ANEURYSM

pp. 242-253

by Anne AMBLARD, Hélène WALTER-LE BERRE, Benyeka BOU-SAÏD & Michel BRUNET

Laboratoire de Mécanique des Contacts et des Solides, INSA CNRS/5514, Villeurbanne, France

***Abstract**: In order to improve endovascular graft used for the treatment of abdominal aortic aneurysm, we develop a methodology to analyse phenomena of type I endoleaks in a non invasive stented abdominal aorta. On the one hand, this study provides an evaluation of the parietal stresses generated by the blood flow. As blood is a shear-thinning, non-Newtonian fluid, we use the Phan-Thien and Tanner model, resulting from the polymer rheology.On the other hand, we develop an axisymmetric finite-element model of the complete system. Plast2, an explicit dynamic finite element code, is used to simulate the behavior of the system subjected to hydrostatic pressure and to the stresses generated by the blood flow. As the response of the solids is strongly affected by the response of the fluid, and vice versa, a coupled fluid-structure interaction is necessary and achieved in this work.*

Engineering Applications

37. THE INFLUENCE OF CAM PROFILE DEVIATIONS ON THE CAM-FOLLOWER COUPLER WITH FLAT DISC LUBRICATION

by Constantin ONESCU & Nicolae POPA

University of Piteşti, Romania

***Abstract**: In this paper it shows that the small variations of cam profiles – undulations or smallest wears – adhesive type, in generally create high variations of the follower accelerations, in this way the inertia force surpass the initial values considered in design of this mechanisms. The contact cam and follower surfaces deforms elastically, sometimes even plastically, generating rectangular contact areas in which exist always rolling and sliding motion. In this context, the present paper studies the influence of the cam profile deviations on the follower movement laws, respectively cam-follower contact and on the tribologic parameters from contact.*

38. ASPECTS OF MOTION TRANSMISSION BETWEEN TWO AXISIMMETRIC BODIES

by Stelian ALACI[1], Romeo GLOVNEA[2] & Florina Carmen CIORNEI[1]

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

[2]Brunel University Uxbridge, United Kingdom

***Abstract**: The paper broadens a series of research papers upon transmitting rotational motion between crossed axes through a high pair obtained from revolving surfaces. Theoretical kinematics aspects of the problem are introduced followed by the description of the test rig and the analysis of the experimental results.*