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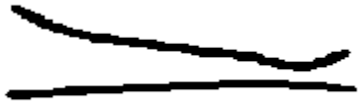

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Contact Mechanics

frequencies, the rubber has a linear elastic behaviour, whereas at high loads and frequencies the hysteresis increases.

3. THE ELASTIC NORMAL CONTACT BETWEEN REVOLUTION RUBBER BODIES

by E. N. Diaconescu[1] & F. Ciutac [2]

[1]*Department of Mechanical Engineering,* University of Suceava, ROMANIA

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Abstract*: The theory of mechanical rubber contacts is based either on nonlinear elasticity or on viscoelasticity. Experimental evidence shows that the former approach is more adequate. The number of works based on this approach is very limited. This paper advances a new theory based on a combined, linear plus power law, dependence of stress on strain. At low loads, the contact behaves in a Hertz fashion, whereas at high loads it becomes purely nonlinear. It is shown that the distribution of pressure remains semi-ellipsoidal and new equations are advanced for contact radius, maximum pressure and normal approach. T high loads, the equation of contact radius yields results in good agreement with existing published results.*

4. A REFINED NUMERICAL METHOD FOR ELASTIC CONTACT PROBLEM WITH A TILTING TORQUE ON THE CONTACT AREA

by Sergiu SPINU

Department of Mechanical Engineering, University of Suceava, ROMANIA

Abstract*: A numerical method for elastic contact analysis valid at any loading eccentricity is refined in this paper by removing the need for an additional Newton Raphson outer loop, which was present in a previously proposed solver. Surface separation equation and pressure correction instruction are modified by adding a term linear in coordinates. Numerical simulations are performed on a circular rigid flat ended indenter with rounding radius pressed eccentrically against an elastic half-space, and the eccentricity effect upon stress state induced in the half-space is assessed.*

Biocontact and Biotribology

bovine bone end and a flat glass window, by recording the dependence of contact radius on normal load. A known theory of the contacts involving thin elastic layers was used to predict the contact radius in axi-symmetrical problems was applied to predict contact radius in the investigated contact. A good agreement was found at higher loads, but smaller experimental radii at low loads.

9. PRELIMINARY EXPERIMENTAL MEASUREMENT OF BIOARTICULAR FRICTION

by Emanuel Diaconescu, Marilena Glovnea, Cornel Suciu & Brânduşa Bejinariu

Department of Applied Mechanics, University of Suceava – Suceava , Romania

***Abstract**: The articular human joints wear out by cartilage failure which leads to drastic friction increase and impediment of current activities. A modern procedure to overcome this deficiency is the reconstruction of ill articulation, essentially by cartilage replacement. The main problem is to evaluate the efficiency of this procedure. This paper presents a method of friction force measurement in rabbit knee joints and comparative friction results between a normal and a repaired joint. It is found that friction is higher and the clearance is smaller in the repaired joint with respect to the normal articulation. This result is supported by topography measurements on mating articular surfaces in both, normal and repaired joint.*

10. UNE METHODE D'EVALUATION DE L'ETAT DES CONTRAINTES POUR UN CONTACT HERTZIENNE; APPLICATION AU CONTACT DENTAIRE EMAIL - POLYMERE

by Luminita IRIMESCU, Florina CIORNEI, Stelian ALACI, Delia CERLINCA & Gheorghe FRUNZA

Génie Mécanique, Université de Suceava, rue Universitatii, no.13, 720225 Suceava, Roumanie

***Abstract**: L'objectif de ce travail est l'évaluation d'état des contraintes à l'interface d'un contact élastique sphère-sphère en condition de chargement normale. Dans le cas du contact entre deux solides soumis à une force normale, les déplacements élastiques de la surface lié aux différences élastiques des matériaux induit une traction tangentielle q, qui a été calculé pour trois cas : glissement total, adhérence totale et glissement partiel ou microglissement, Hills, [1].*

L'état global des contraintes à l'interface du contact a été obtenu en sommant les contraintes induites à la fois par cette traction tangentielle et la charge normale. Ensuite, la contrainte équivalente d'Huber-Mises-Hencky a été calculée numériquement pour le couple de matériaux email - polymère.

characteristics of the entire tribological triplet of the synovial joint. This model reconstitutes the properties of the articular cartilage using a manufactured convex lens in soft HEMA and of the lipid multilayers of the synovial fluid structure using nanophysics techniques. A home-made tribometer was used to measure the tangential force at constant load (friction coefficient); changes in the lipid structure were observed in-situ after long period of friction with fluorescence microscopy. The results of this work show that the DPPC lipid multilayers generated friction coefficients that were small (0.002) and comparable to that found between cartilage surfaces. This low friction stems from the localisation of sliding accommodation in the layer of physiological solution trapped between the two lipid bilayers. These results suggest that the tribological role of the lipid bilayers is mainly physicochemical: it consists of trapping thin layers of physiological solution capable of localising sliding, making it possible to obtain a very low friction coefficient. The results show that the destruction of lipidic multilayers by oxidation (case of DOPC multilayers) and the variation of mechanical properties by the reduction of pH increase the friction coefficient.

14. TRIBOLOGY LOADING CAPACITY OF UHMWPE FROM TOTAL JOINT REPLACEMENTS

pp. 96-108

by Andrei TUDOR, Georgiana BOSOI & Felix PARVU

Polytechnic University of Bucharest, Romania

***Abstract**: The wear rate of ultra-high molecular polyethylene (UHMWPE) total joint prosthesis is known to be influenced by various factors such as material and design. However, it is not known if these factors affect the size or morphology of the wear particles. It is known that the molecular chain structure at the articulating surface of UHMWPE undergoes a re-organization process due to strain accumulation caused by surface traction. A theoretical model of wear particle that is based of intimate conical asperity interactions is proposed to account for the observed differences in sliding and rolling wear. Cyclic plastic strain accumulation is identified as the common cause for wear debris generation in sliding and rolling joints, as examples hip and knee replacements. In the case of acetabular cup wear (sliding velocity), the scale of plastic deformation is limited to the sites of intimate conical-asperity contacts and the wear is defined by a critical strain criterion. In the case of tibial component wear (rolling velocity), however, plastic deformation spreads into the subsurface to the site of macro-asperity contact, and material can be removed by subsurface cracking and delamination. In both cases, the wear rate is strongly affected by the ultimate tensile strength and breaking elongation of UHMWPE material.*

Mems Tribology

Friction and Wear

20. A NEW PIN DISC MICROTRIBOMETER

by Ciprian Stamate, & Dumitru N. Olaru

Machine Elements and Mechatronics Department Technical University "Gheorghe Asachi" Iasi , Romania

***Abstract**: To investigate the sliding friction in microsystems a new pin disc microtribometer having the normal load between 5 mN to 150 mN has been realized. Experimental investigations was realized in order to determine the friction coefficient between a steel spherical surface and steel, glass or silicon plane surface. The new pin-disc microtribometer was attached to a CSM Microtribometer and friction forces with magnitude of 1- 10 mN have been experimentally determined.*

21. A THERMOMECHANICAL WEAR MODEL FOR THE METRO WHEEL IN THE RAIL CONTACT

by Andrei TUDOR[1], Elias TOUNTAS[2] & Nicolae SANDU[3]

[1]Polytechnic University of Bucharest, Romania

[2]Attiko Metro A.E. Athena, Greece

[3]Romanian Authority of Rail Way, Bucharest, Romania

***Abstract**: Tribological phenomena in the wheel – rail contact of metro wagon defines the durability of wheel and rail. The contact pressure and friction temperature change the strength of rail material and wheel material. The correlation of material and operation parameters defines the wear maps. The dimensionless Von Mises parameter is used to limit the elastic deformation for a hertzian contact of wheel and rail. Dimensionless contact pressure loading capacity is obtained by to overlap the thermal and elastic normal and adhesion stresses.*

The thermomechanical wear model of wheel is defined by the fatigue strength of wheel material at the rolling parameters. The effects of adhesion, longitudinal creepage and rolling velocity about the contact pressure loading capacity and the friction fatigue are analyzed.

Lubricants

Hydrodynamic Lubrication

24. A SIMPLIFIED SOLUTION OF STEADY-STATE REYNOLDS EQUATION FOR WORN JOURNAL BEARINGS

by Ing. Maria Brandusa Ilie and Prof. Traian Cicone

University POLITEHNICA of Bucharest, Spl. Independentei 313, Bucharest 060042, ROMANIA

***Abstract**: Journal bearings operating over a great number of years and submitted to frequent starts and stops can be affected by the cumulative effect of wear. In some previous studies it was shown that, in some cases, wear has no significant negative effects or, apparently surprisingly, can be quite beneficial. This was shown based on complex TEHD models with numerical solutions. However, using such complex models that require high computational resources and long CPU time it is very difficult to perform parametric analyses. The objective of the present work is to develop a simplified solution for Reynolds equation for full film journal bearings affected by wear. The model is applied to isothermal, steady-state, 360° journal, but it can be easily adapted to partial journal bearings. The model allows for quick results with acceptable accuracy. The results are obtained numerically, based on simple integration of a 2nd order differential equation. Comparisons with similar results obtained by Fillon and co-workers 0 are very encouraging, showing very small differences with an important gain in CPU time.*

25. ANALYTICAL CALCULATION MODEL OF HYDRODYNAMIC PARAMETRES OF SLIDER BEARINGS

by Mihail IONESCU

Department of Mechanical Engineering, Stefan cel Mare University- Suceava, Romania

***Abstract**: The calculation of the functional parameters of hydrodynamic slider bearings involves 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. The present paper proposes a quantitative calculation of slider bearings, using the analytical solutions of energy equation and of the Reynolds differential equation. The model consists in the transformation of the axial bearing pad into a journal bearing bush.*

The validation consists in comparing the pad's hydrodynamic parameters, calculated by means of numerical methods, with those of the proposed journal bearing, calculated analytically.