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Abstracts

Compiled by Justinas Gargasas

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The aim of the conference is to provide an opportunity to share information and facilitate co-operation in mechatronics, new materials and dissemination of current research results in this multi-disciplinary field. The task of the Conference is not only to acquaint participants with the works of scientists from different countries, but to expand their collaboration in the future.

The abstracts are printed without editing, but as presented by their authors.

For information write to:
Vilnius Gediminas Technical University, Faculty of Mechanics,
Organizing Committee of International Conference MSM-2017
Facuclty of Mechanics, J. Basanavičius str. 28, LT-03224, Vilnius, Lithuania
http://www.msm2017.vgtu.lt/index.php/mechanika/index/pages/view/home2017;
E-mail: msm2017@vgtu.lt

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BUSHING SHAFT ASSEMBLY WEAR CALCULATION PRINCIPLES

Karlis Berzins[1,a*], *Janis Rudzitis*[1,b]
Institute of Mechanical Engineering, Riga Technical university, Viskalu street 36A, Riga, LV - 1006, Latvia
E-mail: [a]viens.karlis@gmail.com, [b]janis.rudzitis@rtu.lv

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ABSTRACT

Wear existed it exists now and it will be present in the future. To calculate wear means to prevent unplanned machinery breakdown by predicting the necessary moment for special wear off part like bushing replacement. Current studies[1] are designed for surfaces with constant nominal contact area for example piston and cylinder.

Bushing shaft assembly differs from piston/cylinder example because the nominal contact area changes depending of wear. The bigger wear the larger nominal contact area. Schematic drawing of bushing and shaft assembly can be seen in figure 1, where x, y, z are ordinate axles, O_v, O centre points, R is bushing inner radius, r is shaft radius, u is wear, L is contact arc length and l is bushings length.

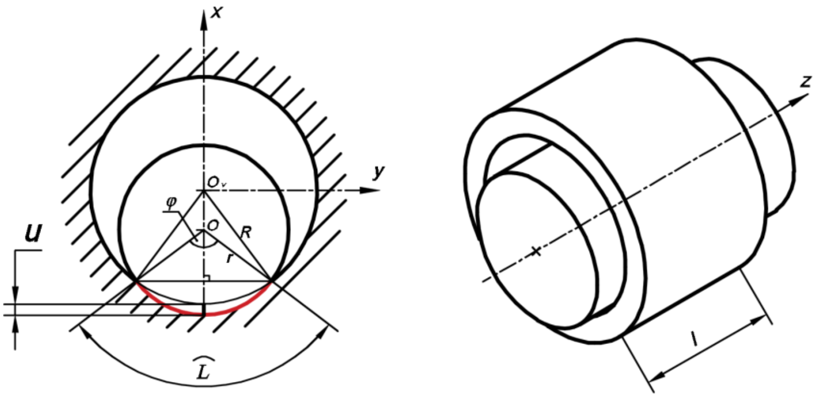

Figure 1: Bushing shaft assembly schematic

Nominal contact area which is determined by part geometrical dimensions

$$A_a = \frac{l\pi r}{180} * 2 * arccos\left(\frac{R^2 - (\Delta + u)^2 - r^2}{2(\Delta + u)r}\right)$$

Is calculated based on *circle-circle intersection* [2] where Δ is clearance fit. Starting nominal contact area

$$A_{as} = \frac{l * \pi * r}{180} \text{arccosin}\left(\frac{b}{r}\right)$$

calculations are based on *Hertz contact stresses*[3], where b is arc length projections half.
Wear calculation are based on experimental theoretical principles. Experimental theoretical method is based on fatigue theory where two surface asperities moving against each other create tension field and after few cycles break. Wear is calculated with formula [1]

$$E\{U_n\} \approx k_{e-m} * k_r * k_{f-m} * \left(\frac{q}{E}\right)^{\frac{2}{3}} * \frac{Sa}{Sm_2^a} * vt,$$

where k_{e-m} is surface anisotropy and fatigue parameter coefficient, k_r is surface roughness parameter complex, k_{f-m} is physical and mechanical parameter complex, q is load (includes previously mentioned nominal contact area), E is Young's modulus, Sa, Sm_2^a are surface roughness parameters, v is velocity and t is duration.

This method is experimental theoretical because currently run-in process cannot be calculated and some parameters should be measured after run-in process. Methodology is carried out in sequence[1]:

- Starting data determination:
  - Kinematic properties (q,v,L_b,t)
  - Material physical properties (m, σ_0, N_0)
  - Material mechanical properties (E, μ))
- Parameter determination after run-in:
  - Surface roughness parameters (Sa,Rsm_1, RSm_2 Sm_2^a);
  - Run-in wear (U_p) and its duration (T_p)

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