ROUGH SURFACE CONTACT – APPLICATION TO BEARINGS

Enescu Ioan[1]
[1]*Transilvania* University Braşov, ROMÂNIA, enescu@unitbv.ro

Abstract:*The asperities on the surface of very compliant solids such as soft rubber, if sufficiently small , may be squashed flat elasticity by the contact pressure,so that perfect contact is obtained throughout the nominal contact area. In general, however contact between solid surfaces is discontinous and the real of contact is small fraction of the nominal contact area. Aplication of this routh asperities on the surfsce is make of rollings bearings*
Keyword: *surface,contact,pressure,rubber,bearing*

1.ELASTIC CONTACT OF ROUGH CURVED SURFACE [2]

We come now to the main question posed,how the elastic contact stresses and deformation between curved surfaces in contact influenced by surface roughness. There are two scales of size in the problem,(1)the bulk (nominal) contact dimensions and elastic compression which would be calculated by Hertz theory for the smooth, mean profiles of two surface, and (2) the height and spatial distribution of the asperities.
We shall consider axi-symmetric case which we can be simplified to the contact of a smooth sphere of radius R with a nominally flat rough surface having a standard distribution of summit heights σ_s, where R and σ_s are related to the radii and roughness of two surfaces by $1/R = 1/R_1 + 1/R_2$ and $\sigma_s^2 = \sigma_{s1}^2 + \sigma_{s2}^2$.
Referring to fig.1 a datum is taken at the mean level of the rough surfaces . The profile of the undeformedsfere relative to the datum is given by

$$y = y_0 - r^2/2R$$

At any radius the combined normal displacement of both surface is make up of a bulk displacement w_b and a asperity displacement w_a. The separation d between the two surface contain only the bulk deformation

$$d(r) = w_b(r) - y(r) = -y_0 + (\frac{r^2}{2R}) + w_b(r) \tag{1}$$

The asperities displacement $w_a = z_s$ -d, where z_s is the height of asperities summit about the datum.
The effective pressure at radius found to be

$$p(r) = \left(\frac{4\eta_s E}{3k_s^{\frac{1}{2}}}\right)\int_d^{\infty} [(z_s] - d(r))^{\frac{3}{2}}\phi(Z_s)dz_s \tag{2}$$

For the normal displacement of an axi-symmetric distribution of pressure p(r) can be written

$$w_b(r) = \frac{4}{\pi E}\int_0^a \frac{t}{t+r} p(t)K(k)dt \tag{3}$$

Where K is the complete elliptic integral of the first kind with argument

$$k = \frac{2(rt)^{\frac{1}{2}}}{r+t}$$

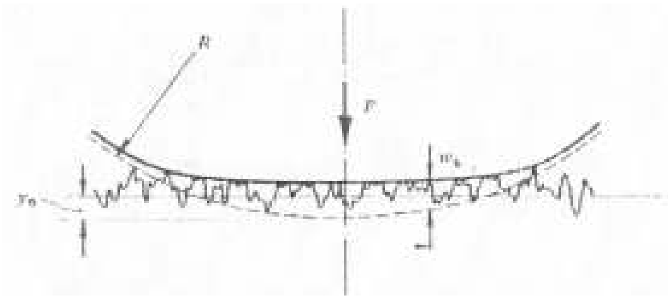

Fig.1

2. BEARING APLICATION [1]

The roughness of the surfaces of the pieces of bearings in contact may be characterized by the parameters

- amplitude parameters
- distance parameters
- bastarg parameters

Amplitude parameters (fig.2)

R_x-parameters most frequent used to the general rough
n- number of discrete deviations
R_a-standard deviation of the profile

$$R_a = \frac{1}{L}\int_0^L |y(x)| \, dx \tag{4}$$

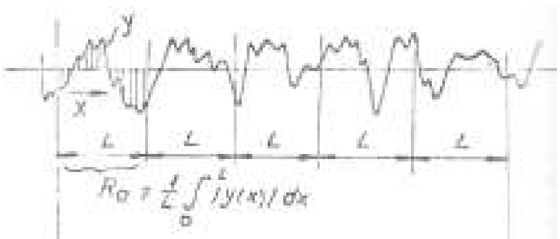

Fig.2

R_{max}-is the distance between the upper- most contact point at the low contact point in the interior point (fig.3)

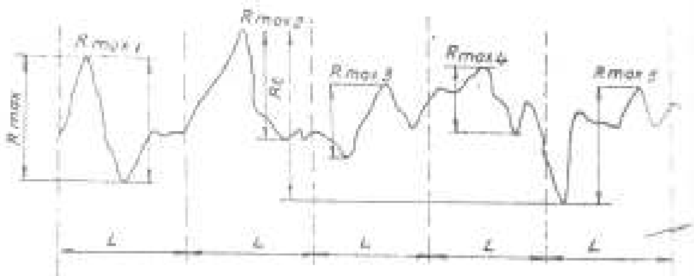

Fig.3

R_t- distance by the most upper-most contact to the most low contact point in evaluation (fig.4)
R_z- average of the absolute values of the most 5 upper-most contact points or the most law contact point

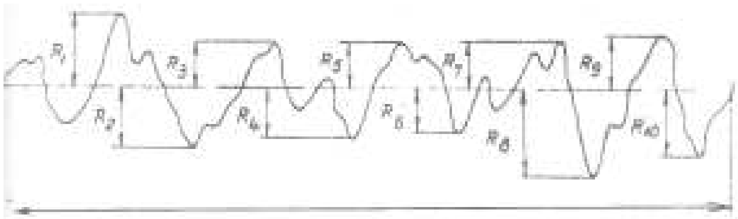

Fig.4

Fig.5

The measure of distribution density of the amplitude of the profile is note S_k where

$$S_k = \frac{1}{Rq^3}\frac{1}{n}\sum_{i=1}^{n} y^3 \qquad (5)$$

Distance parameters

Hsc (High Sport Count) – is the number of the upper-most contact completely project upper the median line or by a parallel of the medianline to a preselected distance p, above the reference line.

The counting is make the base length. A other parameter is S_m,the medium pass of the irregularities of the profile

REFERENCES

[1] I. Enescu, Gh. Ceptureanu,D.Enescu,Rulmenti,EdituraUniversitatiiTransilvania, 2005
[2] K.L.Johnson, Contact mechanics, Cambridge University Press, 1985