THE INFLUENCE OF THE CORRELATION LENGTH ON PRESSURE DISTRIBUTION AND STRESS STATE IN CONCENTRATED ROUGH CONTACTS

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Any parametric study involving roughness requires surfaces with known statistical proprieties and it is much more convenient to generate them numerically rather to measure manufactured rough surfaces. In the first part of the paper the matrix containing the roughness heights is obtained by a linear transformation of the Gaussian input matrix, the coefficients of the transformation matrix being found as solutions of a non-linear system of algebraic equations in which the free terms are the components of the desired autocorrelation matrix. As it was expected the higher the correlation length the smoother is the roughness profile, with longer asperity dimensions.

In the second part of the paper a fast computer code is used to solve the elastic-plastic contact between rough surfaces. Further, the developed algorithm has been used as a tool to point out the role played by the autocorrelation length on both pressure distribution and stress state. In this respect the subsurface stress fields were compared using the von Mises equivalent stress, which is useful for predicting plastic flow.

Key words: concentrated contact, roughness, autocorrelation length, von-Mises stress.

1. INTRODUCTION

The role played by the surface roughness on wear and contact fatigue has been of great interest in tribology of both, rolling and sliding contacts. Every elastic models for the contact of rough surfaces presents very large local asperity contact stresses, able to exceed the yielding limit.

On machined surfaces the waviness and roughness have comparable magnitudes, typically between 0.1 and 10 μm, but the corresponding wavelength may differ by two or three orders of magnitude, so that a typical diameter of the roughness bases is 10 to 100 times larger than their heights, Bushan, [3], Greenwood, [8], Patir, [12,13], Thomas, [18]. Greenwood and Wu, [11], have shown that the contact is governed by the geometry of the micro-asperity only in the very early stages. When the asperity has been compressed to the final stage the micro-asperity may possible have some influence on the actual area of contact, but the nature of contact will depend on the large scale geometry of the asperity.