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A FEM-BASED STUDY ON THE INFLUENCE OF SKEWNESS AND KURTOSIS SURFACE TEXTURE PARAMETERS IN HUMAN DENTAL OCCLUSAL CONTACT

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Abstract. Wear of human teeth is an irreversible condition that occurs with different severity and may lead to loss of integrity and functionality. As dental wear is a contact problem, it is important to investigate the surface quality using quantitative methods. Despite the variety of available tests for measuring surface changes, two statistical variables are the most commonly reported in experimental studies: roughness average and root mean squares (RMS) deviation. Nonetheless, profilometry allows to estimate other statistical parameters of a surface: skewness, the measure of the asymmetry of surface deviations considering a mean plane; and kurtosis, the measure of the peakedness, or sharpness, of the height distribution topography. The approach used to simulate the contact between rough surfaces, given the probability density functions, consists in to discretize them into several intervals, so that each one represent a main asperity. The deformations of the main asperities are analyzed and using homogenization techniques it is possible to establish the relationship among the responses occurred in micro-scale and the predicted responses in macro-scale. In this work we created parameterized scripts in Python language for the Abaqus CAE software in order to analyze the influence of skewness and kurtosis on numerical results for contact of human dental surfaces. We performed four sets of experiments: varying mean roughness, mean peaks curvature, skewness and kurtosis of asperities distribution. The graphical user interface of ABAQUS/CAE module was used to create a model example of contact between an asperity and a rigid plane, and the commands were issued internally by ABAQUS/CAE after each operation and recorded in a script type file in a object-oriented programming language called Python. This file was accessed and parameterized according to the variables of the problem, mainly to include a loop to repeat the modeling tasks and access to the data output for each main asperity considered. A function to assist in the automated generation of geometry based on the texture parameters was defined, which calculates a list of the coordinates of a number of points located on the asperity slope. The script contains all native commands of Abaqus/CAE module, but parameterized. The contact forces and areas for each increment were accessed from the database output and written in the form of a report. After recording all reports, a routine, also in python, was responsible for reading them successively, calculating the expected total values for the interface, taking into account the contribution of each main asperity. Using the library matplotlib, the final curves were plotted. The goals were to verify whether a combination of skewness and kurtosis parameters help us to explain clinically studied cases of dental wear.