World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:11, 2020

An Interlock Model of Friction and Superlubricity

Authors : Azadeh Malekan, Shahin Rouhani

Abstract : Superlubricity is a phenomenon where two surfaces in contact show negligible friction;this may be because the asperities of the two surfaces do not interlock. Two rough surfaces, when pressed against each other, can get into a formation where the summits of asperities of one surface lock into the valleys of the other surface. The amount of interlock depends on the geometry of the two surfaces. We suggest the friction force may then be proportional to the amount of interlock; this explains Superlubricity as the situation where there is little interlock. Then the friction force will be directly proportional to the normal force as it is related to the work necessary to lift the upper surface in order to clear the interlock. To investigate this model, we simulate the contact of two surfaces. In order to validate our model, we first investigate Amontons' law. Assuming that asperities retain deformations in the time scale while the top asperity moves across the lattice spacing Amonton's law is observed. Structural superlubricity is examined by the hypothesis that surfaces are very rigid and there is no deformation in asperities. This may happen at small normal forces. When two identical surfaces come into contact, rotating the top surface we observe a peak in friction force near the angle of orientation where the two surfaces can interlock.

Keywords : friction, amonton`s law, superlubricity, contact model
Conference Title : ICCPA 2020 : International Conference on Computational Physics and Algorithms
Conference Location : Amsterdam, Netherlands
Conference Dates : November 05-06, 2020