Scientists examine the flow of liquid at the contact between randomly rough surfaces

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A team of scientists from Italy and Germany has recently developed a model to predict the friction occurring when a rough surface in wet conditions (such as a road on a rainy day) is in sliding contact with a rubber material (such as a car tire tread block) in an article to be published shortly in the *European Physical Journal E.*

In their study, B.N.J. Persson from the Jülich Research Center in Germany and M. Scaraggi from the Polytechnic of Bari in Italy examined the flow of liquid at the contact between randomly rough surfaces. The contact interface looks like a labyrinth with vertically narrow void channels intersecting randomly. This causes channels to be either filled with water or not when in wet conditions.

For the first time, the authors applied a statistical analytical method to determine the average fluid flow at the interface of rough surfaces. Understanding this flow is important because it is inherently linked to the phenomenon of friction at the contact between the two surfaces.

Previous attempts to understand friction in such conditions used numerical approaches that required large computing power. They were based on calculating real roughness contacts by singling out each individual portion of the overall rough surface under study. Often, heavy approximations in the description of the simulated surface were applied to decrease the computational time.

The model presented in this paper provides theoretical predictions of

friction as a function of the surface sliding velocity. It confirms previous experimental friction measurements made with a smooth steel ball sliding on a rough rubbery surface patterned with parallel grooves. The authors' model confirmed the experimental observation of a changing friction level related to a change in the angle between the direction of movement of the ball and the parallel to the grooves.

Potential applications would require that such a model be used to help create surfaces, such as microstructured tyres, which do not lower their grip when it rains.

More information: Persson BNJ, Scaraggi M (2011). Lubricated sliding dynamics: flow factors and Stribeck curve. *European Physical Journal E.* 34: 113, DOI 10.1140/epje/i2011-11113-9

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