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Numerical study on the elastic-plastic contact between rough surfaces

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ABSTRACT

The frictional contact plays an important role in all forming processes, namely in the sheet metal forming due to the contact between the forming tools and the blank. In fact, the formability (limiting draw ratio) is strongly affected by the frictional conditions, which are directly related with the surface roughness. Accordingly, the contact of rough surfaces has been the subject of a huge amount of studies, comprising theoretical approaches, numerical simulations and experimental measurements. Nevertheless, the connection between the microscopic contact and the macroscopic friction generated by contact is not fully understood, which is essential to improve the numerical models currently adopted in the finite element simulation. Therefore, this work presents the numerical study of the elastic-plastic contact between rough surfaces, allowing to identify the onset of plasticity at the asperities. Since a rough surface can be idealized with a sinusoidal profile, this geometry is adopted in the present study to describe the asperities, while the other body is a flat surface. The evolution of the true contact area under increasing applied pressure is analysed by finite element analysis, allowing to identify the relevant geometrical properties of the surface roughness that influence this evolution. Besides, the distribution of the contact pressure on the asperities is assessed, which is compared with the apparent contact pressure.

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