J.S. (Jan) van Dokkum

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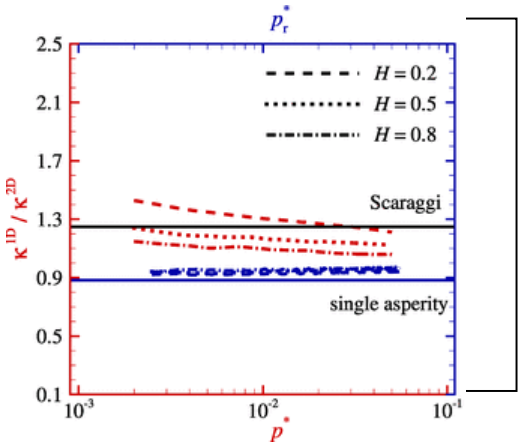
Research topics:
Tribology;
Dislocation Dynamics;
Scientific numerical methods;
Analytical theory.

1. Contact Mechanics & 2. Strain Hardening

Research activity 1:
The relative contact area of rough surface contacts is known to increase linearly with reduced pressure, with a proportionality factor. In its common definition, the reduced pressure contains the root-mean-square gradient (RMSG) of the surface. Although easy to measure, the RMSG of the entire surface does not coincide, at small loads, with the RMSG over the actual contact area, which gives a better description of the contact between rough surfaces. It was recently shown that, for Hertzian contacts, linearity between area and load is indeed obtained only if the RMSG is determined over the actual contact area. Similar to surface contacts, in line contacts, numerical data are often studied using theories that predict linearity by design. In my work, I revisited line contact problems and examine whether or not the assumption of linearity for line contacts holds true.
The simulations in my work show that linearity between relative contact area and load for line contacts is found, only provided that the RMSG is calculated over the actual contact area. This result has inspired us to check the effect of using the local gradient when deriving the proportionality factor in the classical Greenwood and Williamson (GW) model. Despite the simplicity of the original GW model, which does not even include elastic interactions, the agreement between the analytically derived proportionality and that obtained through random rough surface contact simulations is surprisingly in good agreement.

Key publication: van Dokkum, J. S., Salehani, M. K., Irani, N., & Nicola, L. (2018). On the Proportionality Between Area and Load in Line Contacts. *Tribology Letters*, *66*(3), 115.



Ratio between proportionality in line and

Research activity 2:
My second activity has two main topics. The first topic is austenite work hardening behaviour. This work hardening behaviour determines the dislocation density and structure (e.g. tangles, cells and sub-grains). The dislocation density and structure are important input parameters for the dynamic and static recrystallization models, for the precipitation model and in certain situations also for the phase transformation model. The second topic concerns the prediction of tensile behaviour for online control models. This means that simple (e.g., based on rule-of-mixtures) equations must be formulated to describe the tensile behaviour of multi-phase micro-structures. Furthermore, to be able to predict the yield strength correctly an adequate description of the yield-point-elongation phenomena is also required.