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INTERACTIONS BETWEEN THE CONTACT AREA AND SELF-EXCITED VIBRATIONS IN A PARTICLE-SOLID SYSTEM

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The contact area between two contact partners are one important part of the tribological system. Therefore, an investigation of the contact area helps to understand effects like self-exiting vibrations. It is obvious, that those friction-based effects have high interactions between the contact area and the system behaviour. But often it is a challenge to investigate a particle-solid system in the lab, due to changing boundaries from the technical application to a smaller scale [1].

In this work two test setups will be presented, which helps to observe, investigate and influence the contact area in situations like self-excited vibrations. For this, the particles will be pressed together, so there are now a bulk solid, and housed with transparent frames. In one setup the contact area can be observed during external vibrations and in the second setup the changing system behaviour due to a changing contact area will be analysed. [2]

With the first lab scaled test setup the changing contact area per particle over time can be observed with a highspeed camera. There were some unexpected results observed. First, the changing of the contact area over time didn't follow as harmonic as expected due to a harmonic system input. A kind of critical pressure is detected, at which the system behaviour changes significant. Notwithstanding the above, the total contact area distributes more then expected. Not even just the total area per particle, even the numbers of contact points per particle changes from zero to four. This conclude, that the inner pressure distribution is higher then expected and far away from a homogenous state, even during stick-slip vibrations.

With the second setup, the influence of the nominal contact area on the self-excited vibrations can be observed. For this, the nominal contact area will be variated by reducing the number of particles that are in contact with the solid counter body and the stick-slip behaviour will be analysed. On the one side the contact area influences the coefficient of friction at the end of the stick phase, but on the other side a significant influence on the coefficient of friction at the end of the slip phase could not be detected. From this it follows that the contact area influences more the sticking process then the sliding process of a typical stick-slip behaviour of those systems.

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