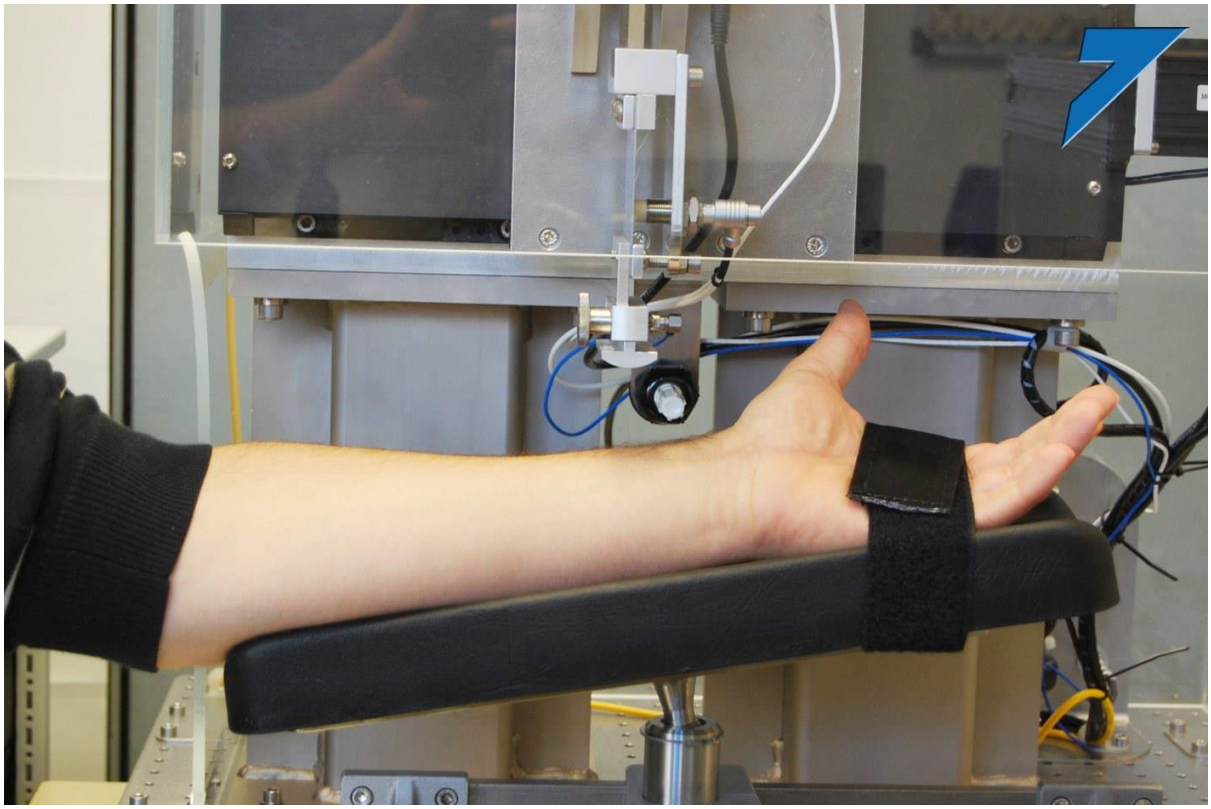

Measuring the in vivo friction properties of skin under the influence of cosmetics and detergents

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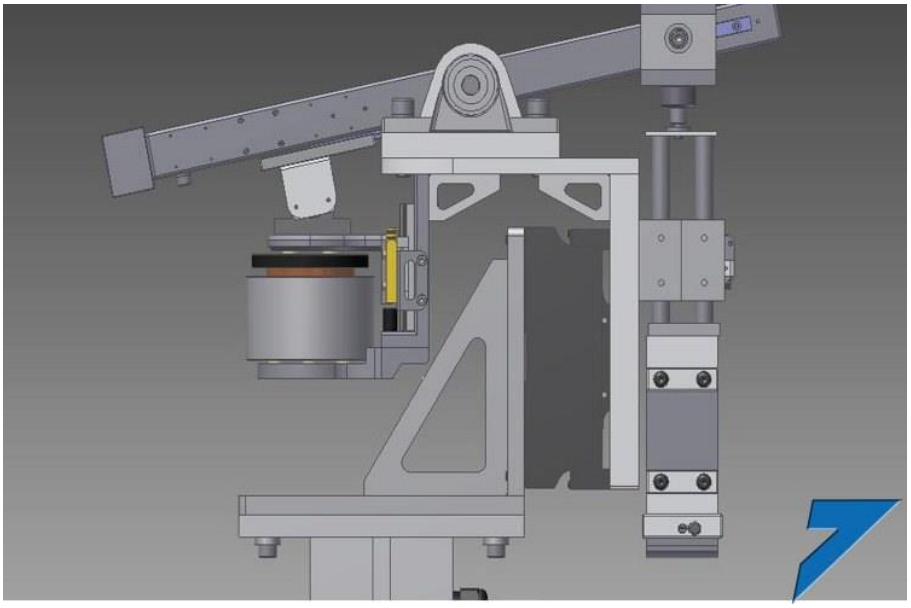
It took quite some time to modify a stick-slip machine for Squeak&Rattle into a machine meeting the needs of cosmetics and detergent industry. Two factors were very important:

- The forces are much lower than contact forces in the car
- a real arm has to be used for the friction and stick-slip tests

The first machine was delivered to a very big German life-sciences company to investigate the influence of different detergents in fashion clothing onto the skin of humans. It was necessary to measure very low friction forces of less than 1 N with high resolution. Therefore many things had to be changed in order to reduce internal friction properties of moving elements in the machine.

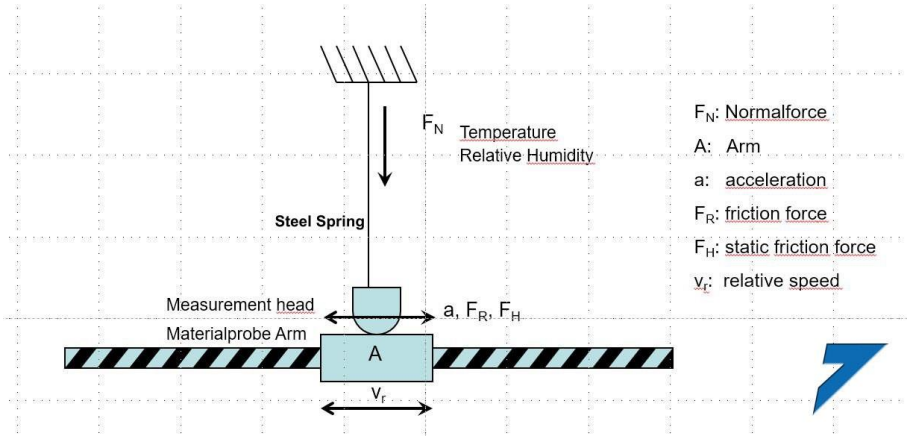


1 - H3P-Derma Cross section of the machine

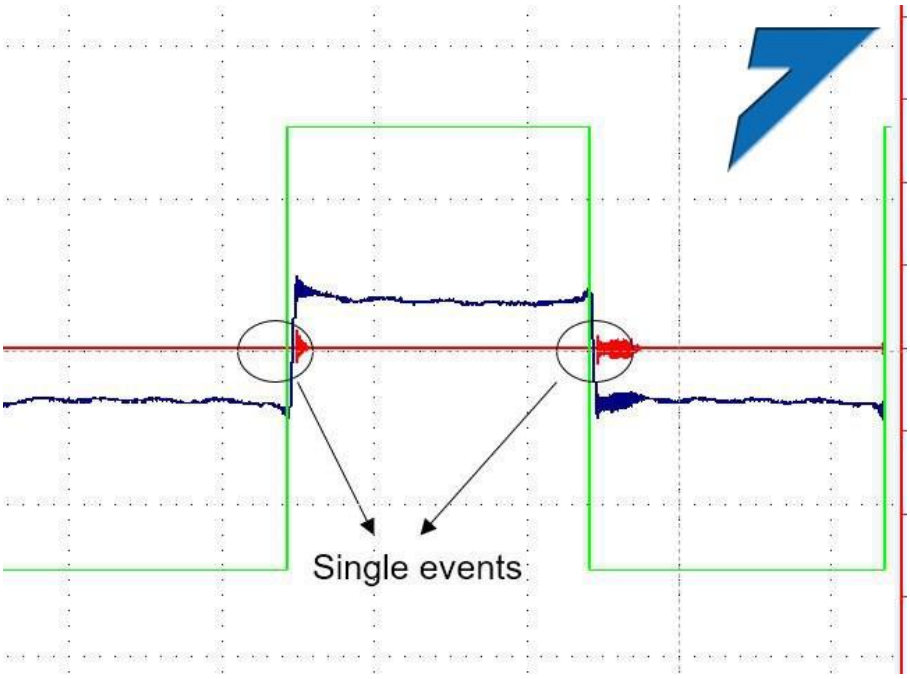
On the left of the lever arm one can see the voice coil that is used to produce a constant force when the test sensor is moving along the arm. On the right side of the lever arm the friction test head can run up and down stabilized by air bearings to have very low friction in the system. The friction test head is a special spring that can bend and the amount of bending is proportional to the friction forces. With this unit it is also possible to measure the very uncomfortable stick-slip effect on the skin.

The measurement principle is shown in the following graph. The measurement head is in touch with the human arm. Depending on the normal force static friction is building up in the contact area. When the machine starts to move the arm forward, the steel spring with the measurement head will follow the motion due to the static friction force and the spring will start to bend. If the material combination has stick-slip then the static friction force will change suddenly into the much lower dynamic friction. If the material combinations have no stick-slip the transition will be smooth. The more the spring is bending the higher is the friction force. This is measured by a sensor which is calibrated to read out the friction force. An additional accelerometer is used to measure stick-slip phenomena. The result will depend on the normal force, the relative velocity, environmental temperature and humidity and of course on the chemical-physical properties in the contact area between measurement head and arm.

Using different detergents or cosmetics will show their influence on friction and stick-slip and will monitor every change in smooth sliding, sticking, surface roughness, braking and other touch haptic properties.

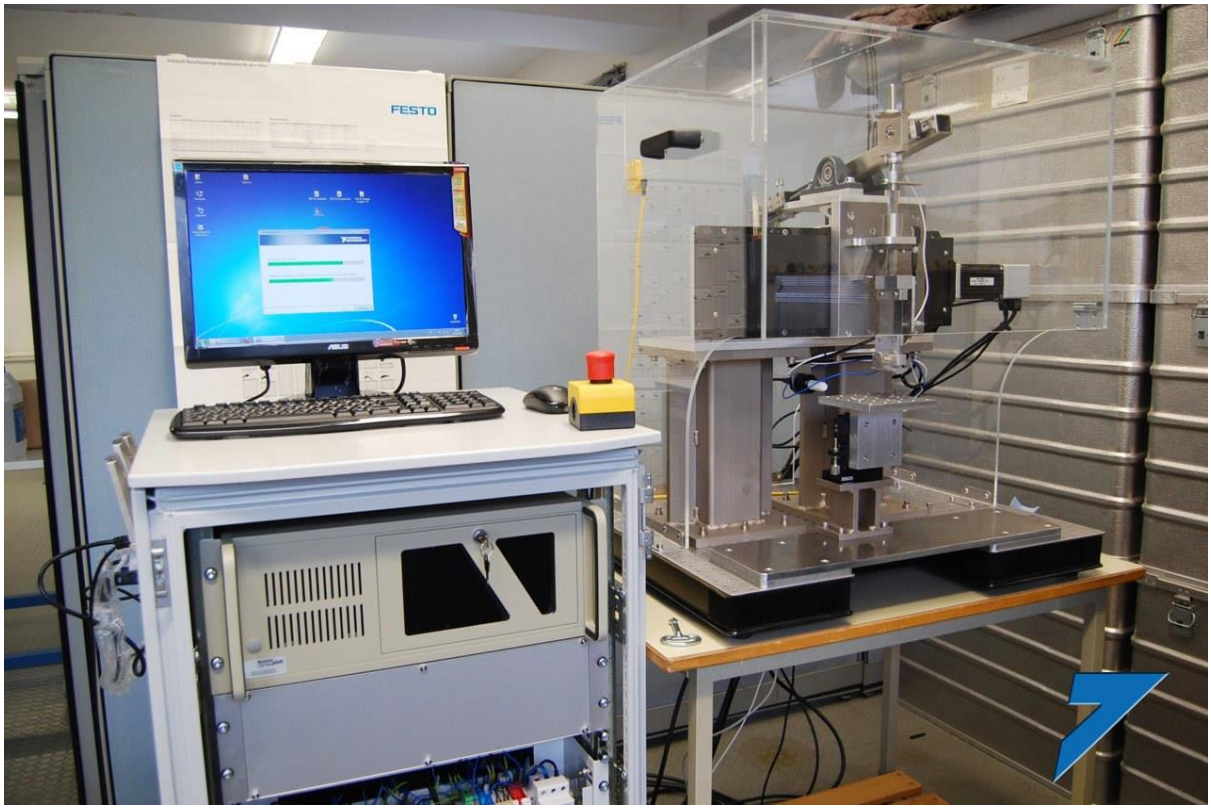


The test result is shown in the next picture. Here we can see the frictional behaviour of the skin, when the arm is moved forward. The blue curve shows the friction properties of the cosmetics on the skin and the red curve gives an indication of instabilities on the skin in form of stick-slip signals.



2 - H3P-Derma test result displaying the effect of cosmetics on the friction of the skin

Conclusions



The H3P-Derma will support the cosmetics and detergent industry in enabling them to objectively measure the change in friction properties of the skin when applying diverse Cremes, beauty-products and cosmetics and to study the effect of infiltration into the skin. It also can help to monitor the effect of detergents in clothes onto the properties of the skin.

For more information in Benelux and France contact www.touch-haptics.solutions

For all other countries contact www.zins-ziegler-instruments.com