



### THE STICK-SLIP EFFECT

**T h e study of the friction forces between two surfaces sliding on one another (tribology) is a research field in full revival. And yet, already in the XVth century, Leonard de Vinci introduced the concept of a friction coefficient.**

Any friction induces vibratory phenomena, which are a source of noise. The first experimental approaches of this phenomenon were made on the study of the movement of small solids on which global measurements were taken. Similarly, modeling of the instabilities related to dry friction was widely applied to discrete systems such as spring dead-head systems.

These systems have often served and still serve as a test bench for

the "fine-tuning" of a friction law capable of accounting for these instabilities.

Fewer studies have been carried out on the dynamic aspect of elastic solids subjected to dry friction. Experimental results on the friction of materials of different hardness are available. During sliding, we observe the formation of detachment folds in the softest material, which is called the "Schallamach wave" and is depicted in the figure below.

Friction is generally quantified by a coefficient  $\mu$ , called the friction coefficient, defined by the relation  $F = \mu L$ , where  $F$  is the friction force and  $L$  the compression load supported by the two bodies in sliding contact. Even though this law has been known for several centuries (Amonotons-Coulomb), it is still very difficult to know the value of  $\mu$  in each situation.

The static friction force is the force which has to be applied to

initiate sliding, while the dynamic friction force is the resistance to motion once it has been initiated. Let us consider the sliding between two bodies: if the driving velocity  $V$  on one of the surfaces is sufficiently high, the sliding will be continuous. On the other hand, if this velocity is less than a critical velocity  $V_c$ , the sliding will be intermittent. In this case, the friction force oscillates regularly between two values.

Over a long period, both surfaces simultaneously move at almost the same velocity: **STICK**. Then above a certain force, both surfaces slide rapidly with respect to each other: **SLIP**, until they stick together again.

Then, a new stick-slip cycle is repeated.

