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The influence of imposed normal vibrations on the frictional sliding along the fault

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Sliding over discontinuities (faults, fractures) in the stable state is prevented by friction. However, the faults are continuously subjected to variations in normal stress and can produce sliding over initially stable fractures/interfaces. In the Earth's crust the normal oscillations can be produced by tidal stresses or by the seismic waves generated by other seismic events. This is associated with the earthquake triggering and leading to a stick-slip sliding. It is conventionally assumed that the mechanism of stick-slip over geomaterials lies in intermittent change between static and kinetic friction and the rate dependence of the friction coefficient. The formulation of the friction law on geological faults is the key element in the modelling of earthquakes.

We investigate the effects of imposed normal vibrations on steady sliding and stick-slip regimes and analyse the dynamics of system with different friction modelling. For this purpose we consider a simple spring-block model introduced by Burridge and Knopoff.

The results show that a model exhibits different behaviour in the frictional sliding with constant and non-linear friction. It is important to note, that a block-spring model can produce oscillations in the velocity of sliding that is the stick-slip like behaviour even when the friction coefficient is constant. The effect of force reduction is observed under the influence of harmonic vertical vibrations. The rate-dependent friction creates more complex pattern of oscillations.