Adhesion disturbed by noise

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Imagine a solid ball rolling down a slightly inclined ramp. What could be perceived as child's play is the focus of serious theoretical research by Manoj Chaudhury and Partho Goohpattader, two physicists from Lehigh University, Bethlehem, Pensylvania, USA. Their study, which is about to be published in *European Physical Journal E*, has one thing in common with childhood behaviour. It introduces a mischievous idea, namely studying the effect of random noise, such as vibrations, on the ball. They found it could lower the energy barrier to set the ball in motion.

The authors used a ramp with a micro-textured surface. This surface is akin to that of a gecko's feet, made of so-called microfibrils capable of adhering to any surface by deforming elastically. They then studied the effect of vibration on a ball left on the top of such a textured ramp. They found that the sphere starts rolling when subjected to a computer-generated random vibration.

To set the ball in motion requires activation energy, the model shows. It has been long known that the same applies to the adhesion of molecules,

on a much smaller scale, as predicted theoretically by the so-called Arrhenius kinetics. This study pinpoints a finite threshold of intensity for the vibration noise above which the ball is set in motion.

This finding could have implications for the removal of water droplets from super-hydrophobic surfaces such as plant leaves. Other applications could also include gecko feet-mimetic adhesives, better adhesion of rubber tires on roads, and the use of fluids, instead of electronics, to perform a digital operation. In addition, new MicroElectroMechanical systems (MEMs), based on robotic fingers capable of displacing a small object, could be assisted by noise.

More information: M. K. Chaudhury and P. S. Goohpattader (2012), Noise activated dissociation of soft elastic contacts, *European Physical Journal E* 35: 131, DOI: 10.1140/epje/i2012-12131-9

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