Supersonic acoustic waves in a supported layer

Francisco Céspedes, Francesc Alzina, **Jordi Gomis-Bresco,** Clivia.M. Sotomaor-Torres
Catalan Institute of Nanoscience and Nanotechnology (ICN2),
CSIC and BIST, Campus UAB, Bellaterra, 08193 Barcelona,
jordi.gomis@icn2.cat

Rayleigh surface acoustic waves (RSAWs), the simplest of guided waves, can be described as non-dispersive surface acoustic waves (SAWs) propagating near the free surface of a homogenous medium with a finite penetration depth into bulk. Typically, in isotropic materials, the amplitude of RSAWs decays exponentially to zero within a depth of several wavelengths. The propagation of RSAWs in elastically anisotropic materials is more complex; thus, velocity and penetration depth strongly depend on the direction, plane of propagation, and elastic anisotropy ratio. Crystal surfaces also support pseudo-SAWs, the velocity of which exceeds the slow transverse bulk velocity. Pseudo-SAWs are leaky because of their coupling to the radiation continuum of bulk modes, but in isolated propagation directions the coupling to bulk modes disappears and true-RSAWs modes, termed supersonic surface waves (SSAWs) appear.[1] Guided waves can propagate in different geometries like supported layers (Sezawa or Rayleigh-Lamb-like waves). Similarly to crystal surfaces, supported layers present leaky waves when the phase velocity exceeds the slow transverse bulk velocity of the substrate.

In this work we present simulations based on the elastodynamic Green's function method to study the presence of SSAWs in supported layers. The effect of the crystallographic orientation of layer and substrate on the properties of the SSAWs is addressed.

References

[1] A. G. Every, J. Acoust. Soc. Am. 138, (2015) 2937.

Figures

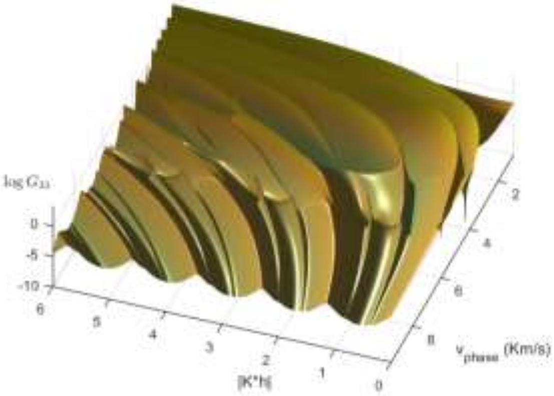

Figure 1: Map of the out of plane G33 component versus the phase velocity and the magnitude of the momentum for the phonon propagation on a h thick gold layer on top a (1 0 0) silicon substrate.