ANISOTROPY EFFECTS ON MAGNON-PHONON INTERACTIONS IN MAGNETIC STRIP-ELASTIC SUBSTRATE HYBRID SYSTEMS

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Magnon-phonon interactions remain a subject of considerable scientific interest due to their unique combination of nonlinear spin wave phenomena and efficient long-range acoustic wave propagation capabilities. Among these interactions, magnetorotational coupling represents a particularly significant mechanism that emerges in systems exhibiting magnetic anisotropy, whether through geometry-related shape anisotropy or uniaxial magnetocrystalline anisotropy, such as perpendicular magnetic anisotropy (PMA).

This investigation [1] presents a comprehensive semi-analytical examination of both conventional magnetoelastic and magnetorotational coupling phenomena governing the interaction between spin waves and surface acoustic waves within an infinitely extended magnetic strip integrated in an elastic substrate (Fig. 1). We systematically investigate the dependence of the magnetoelastic interaction on the direction of applied field. Our analysis differentiates between two distinct surface acoustic wave modes: transverse Love waves (L-SAW) and circularly polarized Rayleigh waves (R-SAW). The findings demonstrate that geometric constraints not only govern spin-wave confinement and pinning phenomena but also substantially modulate the underlying coupling mechanisms. This theoretical framework establishes fundamental principles for the design of hybrid magnetoelastic devices, offering insights for future technological applications.

[1] Centała G., Kłos J. W. (2025) Magneto-rotation coupling for ferromagnetic nanoelement embedded in elastic substrate, J. Appl. Phys., **137**, 233904

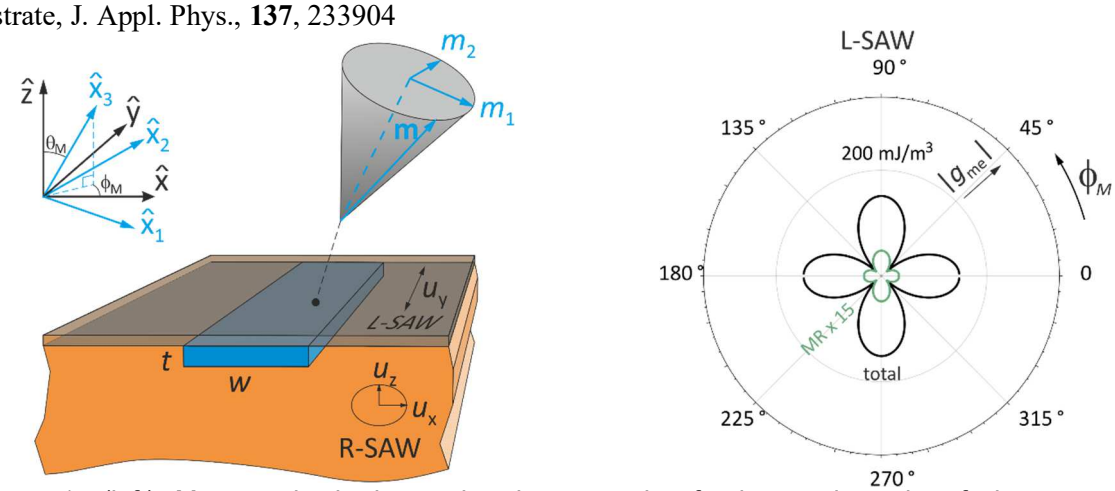

Figure 1. (left) Magnetoelastic interaction between the fundamental mode of the precessing magnetization in a ferromagnetic strip (blue) and surface acoustic waves (SAW) propagating in a non-magnetic substrate (orange) along the *x*-direction, i.e. perpendicularly to the strip. The interaction is not only due to the intrinsic magnetostriction of the ferromagnetic material but also caused by the magnetic anisotropy and related to the magneto-rotation coupling. (right) The exemplary angular dependence of the magnetoelastic energy density for Love surface acoustic waves.

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