

Erratum: “Controlling acoustic waves using magnetoelastic Fano resonances” [Appl. Phys. Lett. 115, 082403 (2019)]

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In the originally published article,¹ the material of the nonmagnetic matrix was mistakenly quoted as silicon nitride. In fact, silicon nitride has a value of the shear modulus that is different from the value of 298 GPa used for plotting graphs.

Furthermore, the effect of refraction was not accounted for in Ref. 1. Hence, although Eq. (8) in Ref. 1 is valid for a wave propagating at angle θ in an infinite sample, it must be replaced by

$$k_{\omega,x}^2 = \frac{\frac{\rho}{C} \omega^2 (\omega^2 - \tilde{\omega}_x \tilde{\omega}_y) - k_{\omega,y}^2 \left(\omega^2 - \tilde{\omega}_x \tilde{\omega}_y + \frac{\gamma B^2}{M_s C} \tilde{\omega}_x \right)}{\left[\omega^2 - \tilde{\omega}_x \tilde{\omega}_y + \frac{\gamma B^2}{M_s C} \tilde{\omega}_y \right]}, \quad (8)$$

where $k_{\omega,y}$ is equal to that of the incident wave. The branch with $\text{Im}k_{\omega,x} > 0$ describes a forward wave decaying into the slab.

Equation (9) for the impedance must be replaced by

$$Z_{\omega,ME}^{(F/B)} = \frac{Ck_{\omega,x}}{\omega} \left(1 + \frac{\gamma B^2}{CM_s} \frac{\tilde{\omega}_y \mp i\omega \frac{k_{\omega,y}}{k_{\omega,x}}}{\omega^2 - \tilde{\omega}_x \tilde{\omega}_y} \right), \quad (9)$$

where “−” and “+” signs correspond to the impedance values for the forward [superscript “(F)”] and backward [superscript “(B)”] propagating waves, respectively. Thus, the impedance is non-reciprocal for finite values of θ .

The magnetoelastic resonance frequency is defined by $\text{Re}Z_{\omega,ME}^{(F/B)} = 0$, and so Eq. (10) must be replaced by

$$\omega_{ME} = \sqrt{\omega_x \omega_y - \frac{\gamma B^2}{M_s C} \omega_y}. \quad (10)$$

This frequency is no longer angle dependent, and so the statement “Note also the θ dependence of the resonant frequency ω_{ME} as reflected in Eq. (10)” must be disregarded.

Equations (11) and (12) for the reflection and transmission coefficients, respectively, must be replaced by

$$R_\omega = \frac{(\tilde{\eta}_\omega + 1)(1 - \eta_\omega) \sin(k_{\omega,x}\delta)}{(\tilde{\eta}_\omega \eta_\omega + 1) \sin(k_{\omega,x}\delta) + i(\eta_\omega + \tilde{\eta}_\omega) \cos(k_{\omega,x}\delta)}, \quad (11)$$

$$T_\omega = \frac{i(\eta_\omega + \tilde{\eta}_\omega)}{(\tilde{\eta}_\omega \eta_\omega + 1) \sin(k_{\omega,x}\delta) + i(\eta_\omega + \tilde{\eta}_\omega) \cos(k_{\omega,x}\delta)}, \quad (12)$$

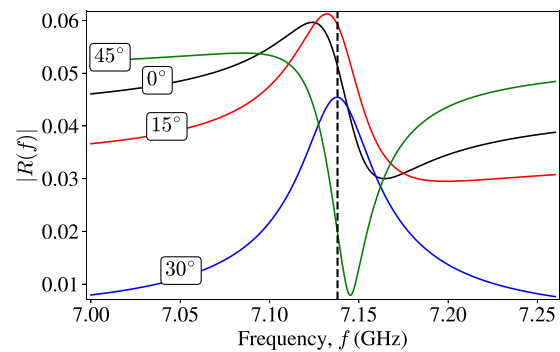


FIG. 3. The reflection coefficient, $R(f)$, in the oblique incidence geometry is determined by the interplay between the enhancement of the magnetoelastic coupling and a non-monotonic variation of the background reflectivity. Colored curves represent specific incidence angles sweeping from 0° to 45° . Moderate Gilbert damping of $\alpha = 10^{-3}$ is assumed. The dashed vertical line corresponds to the magnetoelastic resonance frequency.

TABLE I. Comparison of the figure of merit Υ for different materials, assuming $\delta = 20$ nm, $\mu_0 H_B = 50$ mT, and $C_0 = 298$ GPa.

Parameters	YIG	Co	Py
$\Upsilon(\theta = 0^\circ)$	4.3×10^{-2}	1.7×10^{-3}	2.7×10^{-4}
Γ_R (ns $^{-1}$)	1.9×10^{-4}	7.5×10^{-3}	2.0×10^{-4}
Γ_{FMR} (ns $^{-1}$)	4.4×10^{-3}	4.3	0.74
$\Upsilon(\theta = 30^\circ)$	4.1×10^{-2}	2.5×10^{-3}	2.8×10^{-4}
Γ_R (ns $^{-1}$)	1.8×10^{-4}	1.1×10^{-2}	2.1×10^{-4}
Γ_{FMR} (ns $^{-1}$)	4.4×10^{-3}	4.3	0.74
$f_{ME} = \omega_{ME}/2\pi$ (GHz)	2.97	7.14	6.26
B (MJ m $^{-3}$)	0.55	10	-0.9
C (GPa)	74	80	50
ρ (kg m $^{-3}$)	5170	8900	8720
α	0.9×10^{-4}	1.8×10^{-2}	4.0×10^{-3}
M_s (kA m $^{-1}$)	140	1000	760

where we have denoted $\eta_\omega = Z_{ME}^{(F)}/Z_0$ and $\tilde{\eta}_\omega = Z_{ME}^{(B)}/Z_0$ and Z_0 is the impedance of the nonmagnetic matrix.

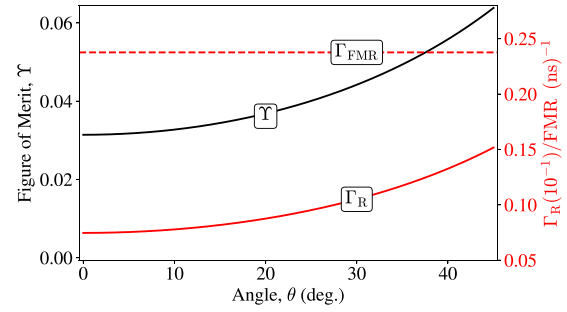
Equations (11) and (12) given here coincide with their counterparts from the original article at normal incidence. However, Fig. 3 is altered and must be replaced by the version here. The amended Fig. 3 reveals interplay between the enhancement of the resonant reflectivity at oblique angles and the angular dependence of the non-resonant reflection amplitude. The latter vanishes at $\theta \approx 30^\circ$ and changes its sign at larger angles.

Equation (13) must be replaced by

$$R_\omega = \frac{i\Gamma_R/2}{(\omega - \omega_{ME}) + i\Gamma_R/2} e^{i\phi} + R_0, \quad (13)$$

where $\phi = -2 \arctan[\frac{C}{C_0} \sqrt{\frac{\omega_x}{\omega_y}} \tan \theta]$ is an extra phase acquired by the resonant contribution at finite θ values. The phase rapidly reaches π already for relatively small values of θ , changing the sign of the Fano interference contribution.

Equations (14) and (15) for the linewidth and figure of merit, respectively, must be replaced by

**FIG. 4.** Both figure of merit Υ and radiative linewidth Γ_R are enhanced in the oblique incidence geometry ($\theta > 0^\circ$). Ferromagnetic linewidth Γ_{FMR} remains unchanged. Co is assumed with $\alpha = 10^{-3}$.

$$\Gamma_R = \frac{\gamma B^2}{2M_s C^2 \cos \theta} \sqrt{\rho_0 C_0} \left(\omega_y \cos^2 \theta + \frac{C^2}{C_0^2} \omega_x \sin^2 \theta \right) \delta, \quad (14)$$

$$\Upsilon = \frac{\Gamma_R}{\Gamma_{FMR}} = \frac{\gamma \delta B^2}{2} \sqrt{\rho_0 C_0} \frac{\left(H_B \cos^2 \theta + \frac{C^2}{C_0^2} M_s \sin^2 \theta \right)}{\alpha C^2 M_s^2 \cos \theta}. \quad (15)$$

This enhances both the linewidth Γ_R and the figure of merit Υ at oblique incidence by a factor of $1/\cos \theta$. If the ratio C^2/C_0^2 is large, Υ may be somewhat reduced at large θ but only slightly.

Table I and Fig. 4 must be replaced by the versions here.

The corrections described here do not change the primary findings of Ref. 1: the magnetoelastic coupling can be manifested in resonant behavior of the acoustic reflectivity, which is enhanced in the oblique incidence geometry.

The amended version of the manuscript can be found at arXiv.org:1906.07297.

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