Article:

Li, Y. orcid.org/0000-0003-1474-3529, Askes, H., Gitman, I.M. et al. (2 more authors) (2023) Band gaps of thermoelastic waves in 1D phononic crystal with fractional order generalized thermoelasticity and dipolar gradient elasticity. Waves in Random and Complex Media. ISSN 1745-5030

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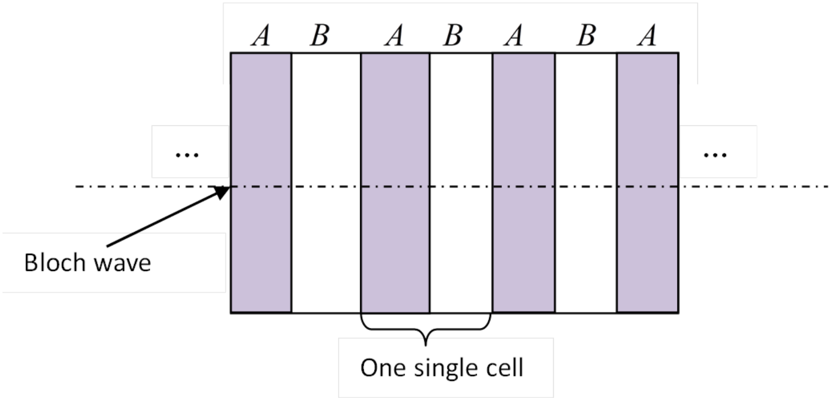


Fig.1 The periodic laminated structure consisting of dipolar gradient thermoelastic solids

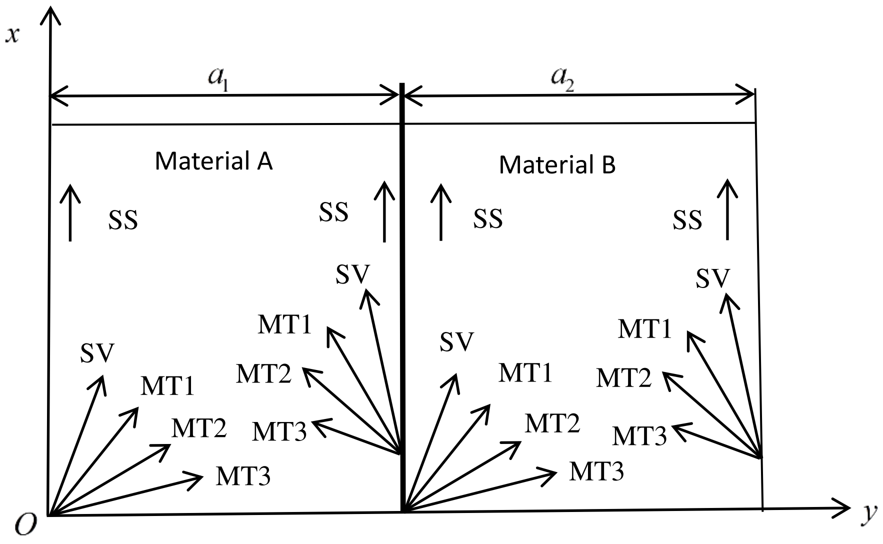
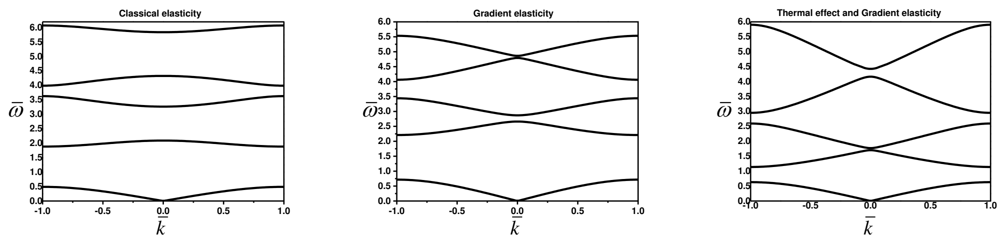


Fig.2 The thermoelastic coupled waves in a typical single cell in oblique propagation

situation



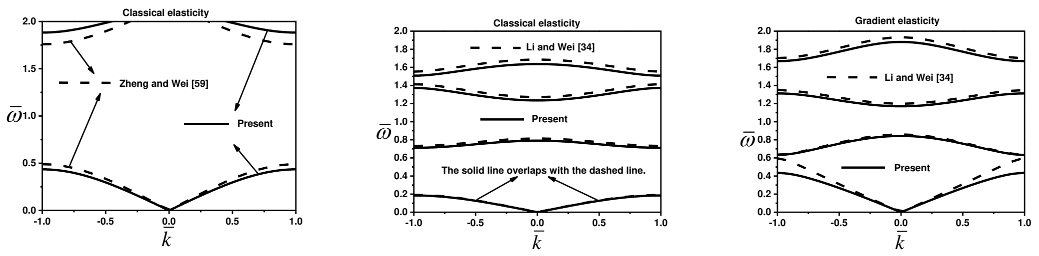
(a) (b) (c)

Fig. 3 Comparison of the dispersion curves and band gaps of phononic structure based on three models in the case of the vertical propagation.

(a) Classical elasticity ($\bar{c}_1 = \bar{c}_2 = \bar{d}_1 = \bar{d}_2 = \bar{\tau}_1 = \bar{\tau}_2 = \alpha_1 = \alpha_2 = 0$);

(b) Gradient elasticity ($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\bar{\tau}_1 = \bar{\tau}_2 = \alpha_1 = \alpha_2 = 0$);

(c) Thermal and gradient elasticity ($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\tau_R = 1$, $\alpha_R = 1$).



(a) (b) (c)

Fig.4 Comparison of dispersion and bandgap with existing literatures.

(a) and (b) the dispersion curves for the classic elastic solids and the comparison with literature [59] and [34]; (c) the dispersion curves for the gradient elastic solids and the comparison with literature [34].

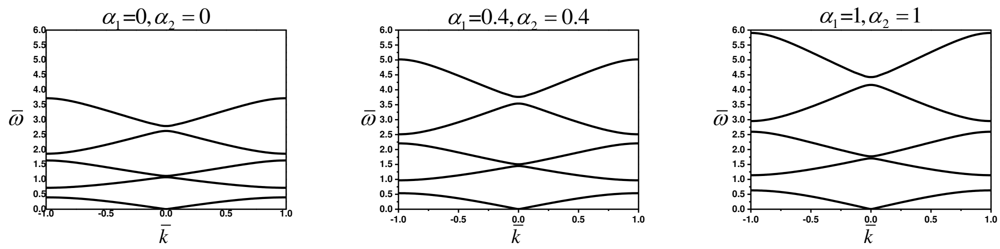


Fig.5. The influence of fractional parameter α on the dispersion curves and the band gaps of Bloch waves (vertical propagation) in the case of gradient thermo-elastic model.

($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\tau_R = 1$).

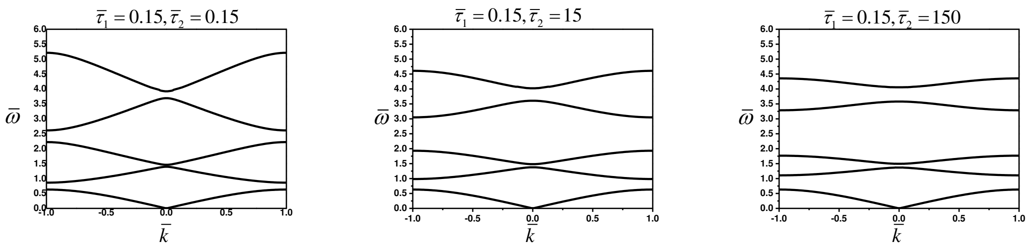


Fig.6. The influence of thermal relaxation time $\bar{\tau}$ on the dispersion curves and the band gaps of Bloch waves (vertical propagation) in the case of gradient thermo-elastic model.

($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\alpha_R = 1$).

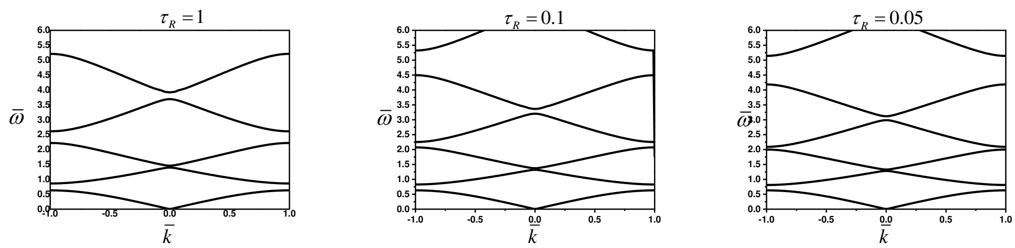


Fig.7 The influence of thermal relaxation time ratio τ_R on the dispersion curves and the band gaps of Bloch waves (vertical propagation) in the case of gradient thermo-elastic model. ($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\alpha_R = 1$, $\bar{\tau}_2 = 0.15$).

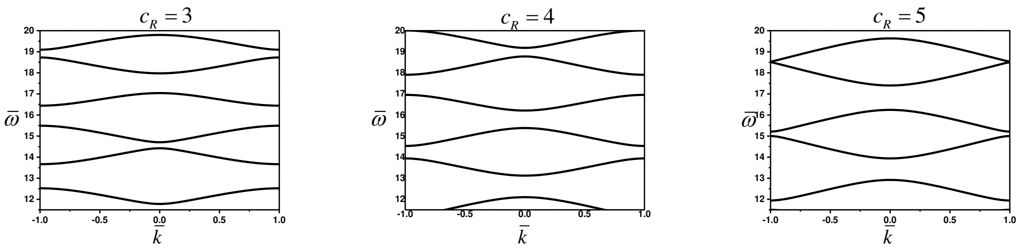


Fig. 8. The influence of micro-stiffness length scale parameter ratio c_R on the dispersion curves and the band gaps of Bloch waves (vertical propagation) in the case of gradient thermo-elastic model.. ($\bar{c}_1 = 0.15$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\alpha_1 = 0$, $\alpha_2 = 0$, $\tau_R = 1$).

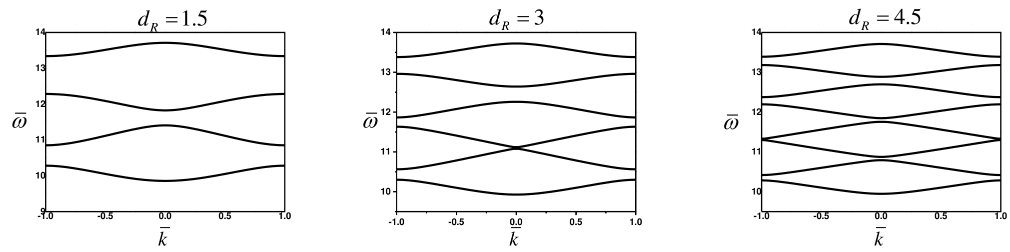


Fig.9. The influence of the micro-inertial length scale parameter ratio d_R on the dispersion curves and the band gaps of Bloch waves (vertical propagation) in the case of gradient thermo-elastic model. ($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $\alpha_1 = 0$, $\alpha_2 = 0$, $\tau_R = 1$).

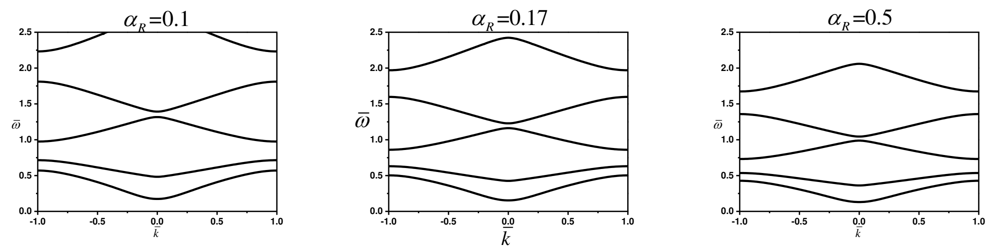


Fig.10. The influence of fractional parameter ratio α_R on the dispersion curves and the band gaps of Bloch waves (oblique propagation) in the case of gradient thermo-elastic model. ($\bar{c}_1 = 0.15$, $c_R = 1.5$, $\bar{d}_1 = 0.25$, $d_R = 1.5$, $\tau_R = 1$, $\alpha_2 = 0.1$, $\bar{\xi}$=2).

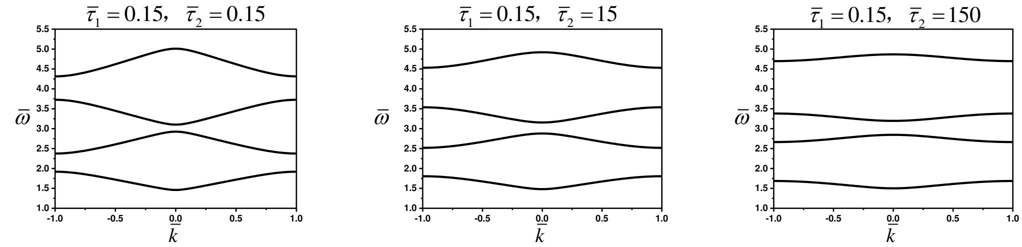


Fig.11. The influence of thermal relaxation time $\overline{\tau}$ on the dispersion curves and the band gaps of Bloch waves (oblique propagation) in the case of gradient thermo-elastic model.

($\overline{c}_1 = 0.15$, $c_R = 1.5$, $\overline{d}_1 = 0.25$, $d_R = 1.5$, $\alpha_R = 1$, $\overline{\xi} = 3$).