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# Wave propagation in a micropolar generalized thermoelastic body with stretch

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**Abstract.** In the present investigation, we discuss two different problems namely, (i) Rayleigh–Lamb problem in micropolar generalized thermoelastic layer with stretch and (ii) Rayleigh wave in a micropolar generalized thermoelastic half-space with stretch. The frequency and wave velocity equations for symmetric and anti-symmetric vibrations are obtained for the first problem. The frequency equation has also been derived for the second problem. The special cases of the above said problems of micropolar generalized thermoelasticity with stretch for Green–Lindsay and Lord–Shulman theory have been discussed in detail. Results of these analysis reduce to those without thermal and stretch effects.

**Keywords.** Wave propagation; micropolar; generalized thermoelastic; stretch; frequency equation.

## 1. Introduction

A theory of micropolar continua was proposed by Eringen and Suhubi [2] and Eringen [4] to describe the continuum behaviour of materials possessing microstructure. Basically, the difference between classical and micropolar theories is that the layer admits independent rotations of the material structure; that is, the local intrinsic rotations (microrotation), which are taken to be kinematically independent of the linear displacement. It is believed that such a theory is applicable in the treatment of granular and fibrous composite material.

In the classical theory of thermoelasticity, the constitutive relations are assumed to be dependent on the time rate of change of the absolute temperature and this idea was advanced by Müller [11] and later the coupled theory of thermoelasticity has been extended by including the thermal relaxation time in the constitutive equations by Lord and Shulman [10] and Green and Lindsay [6]. These new theories eliminate the paradox of infinite velocity of heat propagation and are termed as generalized theory of thermoelasticity.

The linear theory of micropolar thermoelasticity was developed by extending the theory of micropolar continua to include thermal effect by Eringen [5] and Nowacki [12] and is known as micropolar coupled thermoelasticity. Dost and Tabarrok [1] have presented the generalized micropolar thermoelasticity by using Green–Lindsay theory.

Eringen [5] extended his work to include the effect of axial stretch during the rotation of molecules and developed the theory of micropolar elastic solid with stretch. The mechanical model underlying the theory of micropolar elastic solids with stretch can be envisioned as an elastic medium composed of a large number of short springs. These springs possess average inertia moments and can deform in axial direction. The material points in this continuum possess not only classical translation degree of freedom of the deformation vector field but also intrinsic rotations and intrinsic axial stretch.