$p_1(y, z) = p_{11} \cos\pi z,\ T_1(y, z) = T_{11} \cos\pi z$ (3.19)

where the prime in $v'_{11}(y)$ denote the differentiation with respect to y. Expressions for $v_1(y,z)$ and $w_1(y,z)$ have chosen so that the continuity equation (3.13) is satisfied, substituting these expressions into (3.14) to (3.17), we get

$$u''_{11}(y)+R\alpha u'_{11}(y)-\pi^2 u_{11}(y)+\frac{1}{2}Rk_2\ (\alpha u''_{11}(y)-\pi^2\alpha u'_{11}(y)-v_{11}(y)u'''_0+v''_{11}(y)-\pi^2 v_{11}(y)+2v'_{11}(y)u''_0)=Rv_{11}(y)u'_0-R^2GT_{11} \quad (3.20)$$

$$v''_{11}(y)+R\alpha v'_{11}(y)-(\pi^2+M^2)\ v_{11}(y)+\frac{1}{2}Rk_2\ \alpha(v''_{11}-\pi^2 v'_{11})=Rp'_{11}(y) \quad (3.21)$$

$$v'''_{11}(y)+R\alpha v''_{11}(y)-(\pi^2+M^2)\ v'_{11}(y)+\frac{1}{2}Rk_2\ \alpha(\pi^2 v''(y)-v'''_{11}(y)=\pi^2 Rp_{11}(y) \quad (3.22)$$

$$T''_{11}(y)+RP\alpha T'_{11}(y)-\pi^2 T_{11}(y)=RPv_{11}(y)T'_0 \quad (3.23)$$

Eliminating $P_{11}(y)$ between (3.21) and (3.22), we get

$$v''''_{11}(y)+R\alpha v'''(y)-(2\pi^2+M^2)\ v''_{11}(y)-R\pi^2\alpha v'_{11}+(\pi^4+\pi^2 M^2)\ v_{11}(y)=\frac{1}{2}R\alpha k_2\ (v''''_{11}(y)-\pi^2\ v'''(y)+\pi^2 v''_{11}-\pi^4\ v'_{11} \quad (3.24)$$

The corresponding boundary conditions are

$y=0;\ u_{11}=0,\ v_{11}=-\alpha, v'_{11}=0,\ p_{11}=0,\ T_{11}=0,$
$y\to\infty;\ u_{11}=0,\ v_{11}=0,\ v'_{11}=0,\ p_{11}=0,\ T_{11}=0$ (3.25)

If we consider very small values of visco-elastic parameter k_2, then substituting

$u_{11}=u_{110}(y)+k_2 u_{111}(y)+0(k^2_2)$
$v_{11}=v_{110}(y)+k_2 v_{111}(y)+0(k^2_2)$ (3.26)

in the equations (3.20) and (3.24) and equating the coefficient of like powers of k_2, we get

$$u''_{110}+R\alpha u'_{110}-\pi^2 u_{110}=Rv_{110}u'_0-R^2GT_{11} \quad (3.27)$$

$$u''_{111}+R\alpha u'_{111}-\pi^2 u_{111}=\frac{1}{2}R[2v_{110}u'_0-\alpha u''_{110}+\pi^2\alpha u'_{110}+v_{110}u'''_{110}-v_{110}+\pi^2 v_{110}-2v'_{110}u''_0] \quad (3.28)$$

$$v''''_{110}(y)+R\alpha v'''_{110}(y)-(2\pi^2+M^2)\ v''_{110}(y)-R\pi^2\alpha v'_{110}+(\pi^4+\pi^2M^2)v_{110}=0 \quad (3.29)$$

$$v''''_{111}(y)+R\alpha v'''_{111}(y)-(2\pi^2+M^2)\ v''_{111}(y)-R\pi^2\alpha v'_{111}+(\pi^4+\pi^2M^2)\ v_{111}=\frac{1}{2}R\alpha[v''''_{110}+\pi^2 v'''_{110}+\pi^2 v''_{110}-\pi^4 v' \text{[illegible]} \quad (3.30)$$

The corresponding boundary conditions are

$y=0;\ u_{110}=0,\ u_{111}=0,\ v_{110}=-\alpha,\ v_{111}=0$
$y\to\infty;\ u_{110}=0,\ u_{111}=0,\ v_{110}=0,\ v_{111}=0$ (3.31)

The differential equations (3.27) to (3.30) can be solved with the help of the boundary conditions (3.31).

The solutions of (3.27) to (3.30) and (3.23) are as follows:

$$u_{110}=B_{29}e^{-\lambda_4 y}+B_{22}e^{-m_1 y}+B_{23}e^{-m_2 y}+B_{24}e^{\text{[illegible]}}\ B_{25}e^{-m_4 y}+B_{26}e^{-m_5 y}-B_{27}e^{-m_6 y}-B_{28}e^{-\alpha_2 y}$$

$$u_{111}=B_{38}e^{-\lambda_4 y}+B_{39}e^{-\alpha_2 y}+B_{40}e^{-m_1 y}+B_{41}e^{-m_2 y}+B_{42}e^{-m_3 y}$$