Substituting (4.75) into (4.74) yields

$$\varphi\,\sigma\,H_{liq}\,\Phi = \left\{\frac{d\phi_{liq}}{dx^*} + \Phi\,N_3\,\omega_0\right\} + \frac{\Theta_0}{k}\left\{\frac{d\phi_{vap}}{dx^*} + \Phi\,N_4\,\Omega_0\right\} - H_{liq}\,\frac{d\Psi_1}{dx^*}. \tag{4.76}$$

The complete solution for $\sigma(l)$ has been obtained by substituting (4.67), (4.72) and (4.73) into (4.76) which is then solved numerically using Maple.

4.5.5 Stability of the isothermal steady state with unique solution

As we have mentioned earlier that the transcendental equation (4.63) has unique solution if the weight factor of the heavier fluid over the liqhter fluid is ignored in the basic state. Now we will discuss the stability of this unique front position.

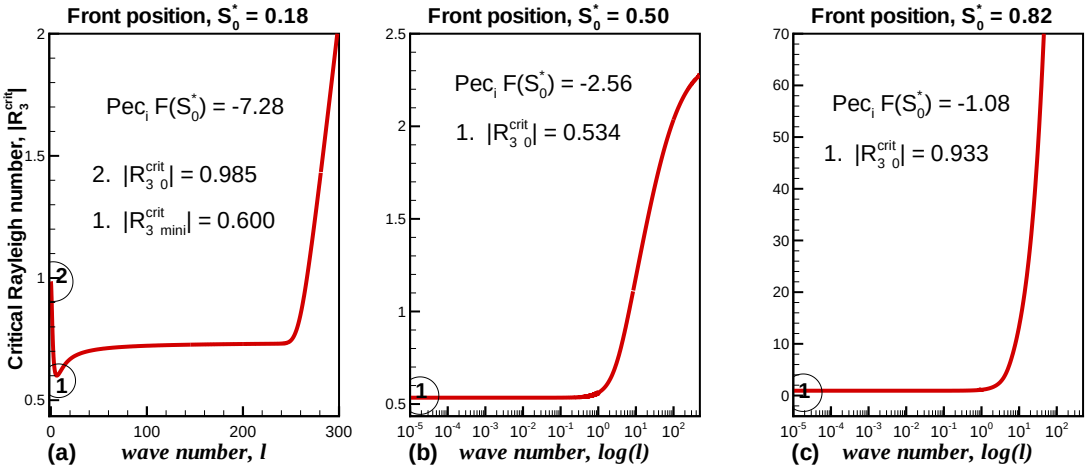

Figure 4.13: The dependence of Rayleigh number on wave number for the steady state with unique solution, where $\varphi = 0.38$, $R_1 = 0.0006$, $R_2 = 8.75$, $E_1 = 1$, $E_2 = 1$, $C = 2.01$, $k = 27$, $H_{liq} = 8.74$, $\Theta_0 = 2$, $R = 22.11$ and $R_3 < 0$.

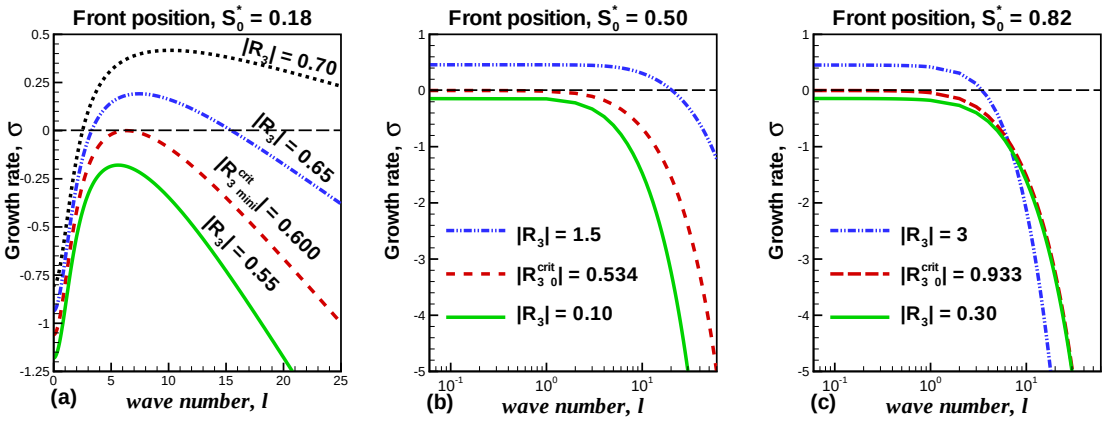

Figure 4.14: Influence of the Rayleigh number on the stability of the isothermal steady state with unique solution, where $R_3 < 0$, i.e. liquid overlies vapour.