ROSSELAND APPROXIMATION CODE

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The file *Sample.m* contains sample code on how to call the Rosseland approximation function. The code is based off of a one-dimensional, steady state consideration of the energy balance of a one-dimensional medium. Review notes for when Rosseland approximation is appropriate for use.

The standard equation in one dimension is

$$0 = \frac{d}{dz}\left(k_c \frac{dT}{dz} + k_R \frac{dT}{dz}\right) \tag{1}$$

with equivalent boundary conditions $T(z_0) = T_0$ and $T(z_L) = T_L$

The code assumes you have non-dimensionalized Eq. (1) with the following non-dimensional parameters

$$\theta = \frac{T}{T_0} \qquad \tau = \beta_R z \qquad N = \frac{k_c \kappa}{4n^2 \sigma T_0^3} \tag{2}$$

to find

$$0 = N\frac{d^2\theta}{d\tau^2} + 4\theta^2\left(\frac{d\theta}{d\tau}\right)^2 + \frac{4}{3}\theta^3\frac{d^2\theta}{d\tau^2} \tag{3}$$

Therefore, the function expects to be called in the following manner

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[tau, theta] = rosseland(T0, TL, tau0, tauL,N)
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where your boundary conditions are

$$\theta_0 \rightarrow T0 \qquad \theta_L \rightarrow TL$$

at the locations

$$\tau_0 \rightarrow tau0 \qquad \tau_L \rightarrow tauL$$

with your conduction-to-radiation parameter N.

The program then provides the two vectors of dimensionless axis τ and temperature θ

$$tau \rightarrow \tau \qquad theta \rightarrow \theta(\tau)$$