Chapter 1

Altering the background state

Here, we describe the artificially convectively stabilized model used in our computations. The dimensionless radial co-ordinate is denoted by $r$, where $r$ expresses fractions of the solar radius $R_\odot = 6.959894677 \times 10^{10}$ cm. For $r < 0.98$, background properties as prescribed by model S (Christensen-Dalsgaard et al., 1996) are used. In the range $0.9998 \geq r \geq 0.98$, the empirical formulae:

\begin{align*}
\rho_0 &= 4.1522194 \left[0.998989 - r + 4.36138(r - 0.98)^{2.1}\right]^{2.009828}, \\
p_0 &= 2.7392767 \times 10^{15} \left[0.998989 - r + 4.36138(r - 0.98)^{2.1}\right]^{3.009828}, \\
g &= -\frac{1}{\rho_0 R_\odot} \frac{dp_0}{dr}, \\
\Gamma_1 &= \max(\Gamma_1^S, 1.507550),
\end{align*}

where $\Gamma_1^S$ is the first adiabatic index of model S, are implemented. In the region $1.002 \geq r \geq 0.9998$, an isothermal layer is utilized:

\begin{align*}
\rho_0 &= 4.5260638 \times 10^{-7} \exp[7690.7995(0.9998 - r)] \\
p_0 &= 1.0252267 \times 10^5 \exp[7690.7995(0.9998 - r)] \\
g &= 24998.23
\end{align*}

Density ($\rho_0$) is expressed in units of g cm$^{-3}$, pressure ($p_0$) in dynes cm$^{-2}$, gravity ($g$) in cm s$^{-2}$, the first adiabatic index ($\Gamma_1$) is dimensionless, and the sound speed ($c$) in
units of cm s$^{-1}$ is given by:

$$c = \sqrt{\frac{\Gamma_1 p_0}{\rho_0}}.$$  \hspace{1cm} (1.8)