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:

$$
\begin{aligned}
\rho_0 &= 4.1522194 \left[0.998989 - r + 4.36138(r - 0.98)^{2.1}\right]^{2.009828}, && (1.1)\\
p_0 &= 2.7392767 \times 10^{15} \left[0.998989 - r + 4.36138(r - 0.98)^{2.1}\right]^{3.009828}, && (1.2)\\
g &= -\frac{1}{\rho_0 R_\odot}\frac{dp_0}{dr}, && (1.3)\\
\Gamma_1 &= \max(\Gamma_1^S, 1.507550), && (1.4)
\end{aligned}
$$

where Γ_1^S is the first adiabtic index of model S, are implemented. In the region $1.002 \geq r \geq 0.9998$, an isothermal layer is utilized:

$$
\begin{aligned}
\rho_0 &= 4.5260638 \times 10^{-7} \exp[7690.7995(0.9998 - r)] && (1.5)\\
p_0 &= 1.0252267 \times 10^{5} \exp[7690.7995(0.9998 - r)] && (1.6)\\
g &= 24998.23 && (1.7)
\end{aligned}
$$

Density (ρ_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 (Γ_1) is dimensionless, and the sound speed (c) in units of cm s^{-1} is given by:

$$c = \sqrt{\frac{\Gamma_1 p_0}{\rho_0}}. \tag{1.8}$$