

Numerical Solutions for the Radial Equation for the 3D Oscillator

Reduced mass: $\mu := 1$ Angular momentum: $L := 0$ Integration limit: $r_{\max} := 6$

Force constant: $k := 1$

Solve Schrodinger's equation numerically use Mathcad's ODE solve block:

Given

$$\frac{-1}{2 \cdot \mu} \cdot \frac{d^2}{dr^2} \Psi(r) - \frac{1}{r \cdot \mu} \cdot \frac{d}{dr} \Psi(r) + \left[\frac{L \cdot (L + 1)}{2 \cdot \mu \cdot r^2} + \frac{1}{2} \cdot k \cdot r^2 \right] \cdot \Psi(r) = E \cdot \Psi(r) \quad \Psi(.001) = .1 \quad \Psi'(.001) = .1$$

$$\Psi := \text{Odesolve}(r, r_{\max}) \quad \text{Normalize the wavefunction:} \quad \Psi(r) := \left(\int_0^{r_{\max}} \Psi(r)^2 \cdot 4 \cdot \pi \cdot r^2 \, dr \right)^{\frac{-1}{2}} \cdot \Psi(r)$$

Energy guess: $E \equiv 7.5$

