Contents

List of Figures

List of Tables

1 Quantum Harmonic Oscillator

Discussion of Theory

Discussion of Implementation

The vibrational wavefunctions were calculated using both the shooting-bisection and the Numerov-Cooley methods, on a grid $X_N = \{x_1, \ldots, x_N\}$. The grid X_N was constructed such that $x_1 = -5$, $x_N = 5$, with varying $N_k = 2^k$, and hence with correspondingly varying step size $(\delta x)_k = 10 \times 2^{-k}$, for $k = 10, \ldots 17$.

Wavefunctions

It was observed that the wavefunctions had converged indistinguishably close to the analytic functions by the first data point $k = 10$, corresponding to $N = 1024$ and $(\delta x) = 0.0097656$. Hence, we simply present the wavefunctions for one data point, $k = 15$.
The $n = 0, \ldots, 3$ wavefunctions, calculated using the shooting-bisection method with, are compared with the analytic wavefunctions in Figure 1.

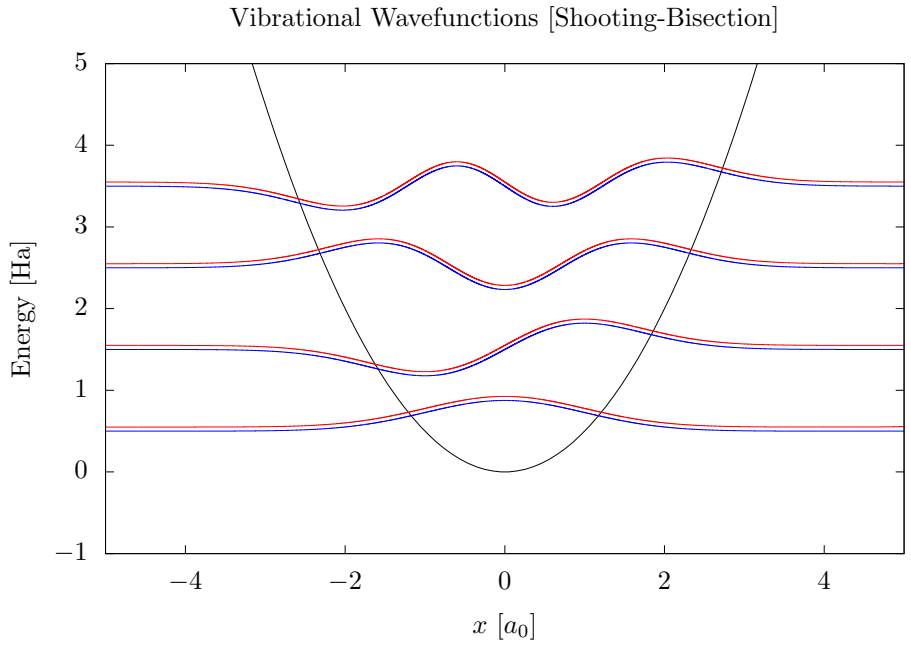

Figure 1: Blah blah.

The $n = 0, \ldots, 3$ wavefunctions, calculated using the Numerov-Cooley method, are compared with the analytic wavefunctions in Figure 2.

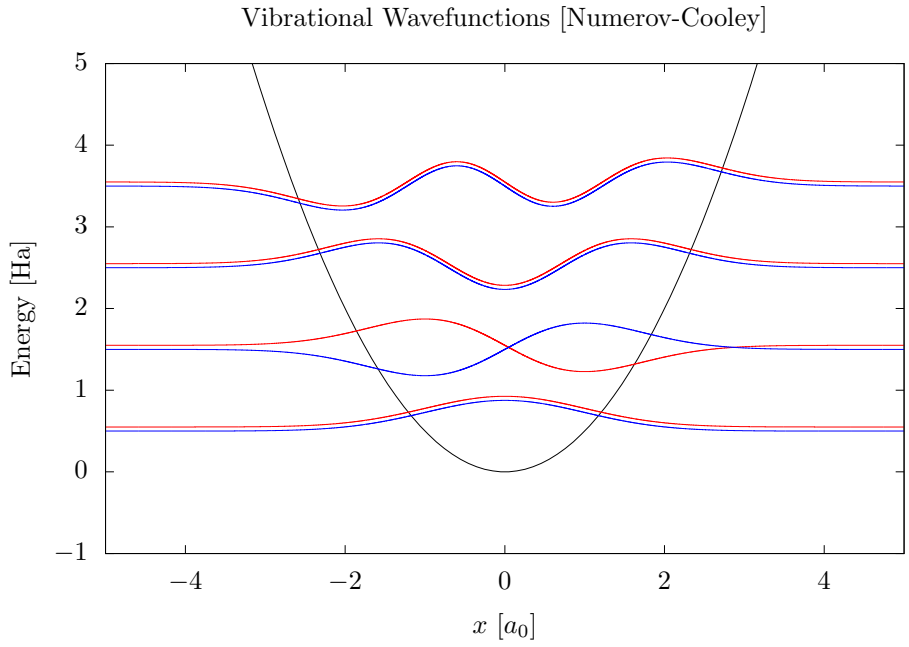

Figure 2: Blah blah.

Energies

Iterations