Quantum Information and Computing

Assignment 5 (due in three weeks)

November 12, 2024

1. **Time-dependent Schrödinger Equation** Consider the time-dependent one-dimensional quantum harmonic oscillator defined by the Hamiltonian:

$$H = \frac{\hat{p}^2}{2m} + \frac{\omega^2(\hat{q} - q_0(t))^2}{2m} \tag{1}$$

   with $q_0(t) = t/T$ and $t \in [0 : T]$. Given $|\Psi_0\rangle = |n = 0\rangle$ (ground state of the Harmonic oscillator), compute $|\Psi(t)\rangle$ for different values of T. Plot the square norm of $|\Psi(t)\rangle$ as a function of q at different times, and the average position of the particle as a function of t.