Quantum Mechanics 2

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Chapter 1

Harmonic Oscilator

Harmonic Oscilator is one of the few problems which is completely solvable in QM. It is used to approximate a function at a minima.

The potential is as follows:

$$V(x) = \frac{1}{2}m\omega^2 x^2$$

In classical mechanics, the general solution for a harmonic oscilator is as follows:

$$x(t) = A\cos\omega t + \sin\omega t$$

We can differentiate accordingly and find the momentum of the particle. The entire system is defined by the initial condition of the particle.

Now, coming to quantum mechanics, we will assume a wavefunction, $|\psi\rangle$. The corresponding Hamiltonian, H will be as follows:

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 x^2$$