Time development of a coupled two level system

$$E = \frac{\varepsilon_a + \varepsilon_b}{2}$$

The Hamiltonian for this case is: $\begin{pmatrix} \varepsilon_a & V_{ab} \\ V_{ba} & \varepsilon_b \end{pmatrix}$

$$\Delta = \frac{\varepsilon_a - \varepsilon_b}{2}$$

Given that you start in state |a>, what is the time-dependent probability of ending up in state |b>?

Frequency splitting: $\Delta := 1$

Rabi frequency: $\Omega(V) := \sqrt{V^2 + \Delta^2}$

Note here I have expressed energy as inverse time. E/hbar

$$P(t, V) := \left[\frac{V^2}{\left(V^2 + \Delta^2\right)}\right] \cdot \sin(\Omega(V) \cdot t)^2$$

Define a time grid: $i := 0 .. 500 \qquad \tau_i := \frac{i}{50}$

Calculate probabilities for different values of the coupling: V/Δ = 0.1, 0.5, 1, 5

$P1_i := P(\tau_i, 5) \qquad P2_i := P(\tau_i, 1) \qquad P3_i := P(\tau_i, 0.5) \qquad P4_i := P(\tau_i, 0.1)$