$$i\partial\psi_i = [F_{\psi_i} + V(t)] \qquad \psi_i(t) = d^i_{mn}(t)e^{i\epsilon_m t}\overline{\psi}_m \qquad F_0\psi_p = \epsilon_p\overline{\psi}_p \tag{1}$$

$$i\dot{d}^i_m = (F_{nm} - \delta_{nm}\epsilon + V_{mn})d^i_m e^{i(\epsilon_n - \epsilon_m)}t \tag{2}$$

$$X_{nm} = \langle\psi_n|\hat{X}|\psi_m\rangle \tag{3}$$

$$\langle\overline{\psi}_p|\overline{\psi}_q\rangle = \delta_{pq} \tag{4}$$

$$i\dot{d}^{0i}_m = 0 \qquad \psi_i(t_0) = d^{0i}_m\overline{\psi}_m \qquad \psi_i(t_0) = d^{0i}_m \neq \delta_{mi} \tag{5}$$

$$i\dot{d}^{1i}_m = (F^1_{nm} + V^1_{nm})d^{0i}_m e^{i(\epsilon_n - \epsilon_m)}t \tag{6}$$

$$\rho_k = \psi^\dagger_i\Sigma_k\psi_i = d^{i*}_l d^i_s e^{i(\epsilon_l - \epsilon_s)}t\overline{\Psi}^\dagger_l\Sigma_k\overline{psi}_s \tag{7}$$

$$\rho_k = D_{sl}e^{i(\epsilon_l - \epsilon_s)t}\Omega^k_{ls} \tag{8}$$

$$\nabla\rho_k = D_{sk}e^{i(\epsilon_l - \epsilon_s)t}\nabla\Omega^k_{ls} \tag{9}$$

$$F^1_{nm} = \frac{dF_{nm}}{dD_{sl}}D^1_{sl} = \frac{d\tilde{F}_{nm}}{dD_{sl}}e^{i(\epsilon_j - \epsilon_s)t}((d^{0j}_l)^* d^{1j}_s + (d^{1j}_l)^* d^{0j}_s) \tag{10}$$

$$F^1_{nm}d^{0i}_m = F^1_{mi} = K_{mi,sj}e^{i(\epsilon_j - \epsilon_s)t}d^{1j}_s + K_{mi,jl}e^{i(\epsilon_l - \epsilon_j)t}(d^{1j}_s)^* \tag{11}$$

$$K_{mm,ls} = \frac{d\tilde{F}_{nm}}{dD_{sl}} \tag{12}$$

$$i\dot{d}^{1i}_m = (K_{mi,lj}e^{i(\epsilon_j - \epsilon_l)t}) + (K_{mi,jl}e^{i(\epsilon_l - \epsilon_j)t})(d^{1j}_l)^* \tag{13}$$