$$\hat{H} = \epsilon_0 \hat{n}_0 + \epsilon_0 \hat{m}_0 + \left(1 - \frac{\hat{n}_0}{N_c}\right)^p \sum_{k=1}^{K} \epsilon_k \hat{n}_k + C_0 \left(\hat{a}_0^\dagger \hat{b}_0 + \hat{b}_0^\dagger \hat{a}_0\right) .$$