$$\left[\hat{c}_{l,\sigma}, \hat{c}_{l',\sigma'} \right] = \left[\hat{c}_{l,\sigma}^{\dagger}, \hat{c}_{l',\sigma'}^{\dagger} \right] = 0$$

$$\left[\hat{c}_{l,\sigma}, \hat{c}_{l',\sigma'}^{\dagger} \right] = \delta(l,l') \cdot \delta(\sigma,\sigma')$$

$$\hat{c}_{l,\uparrow}^{(\dagger)} \leftrightarrow \hat{c}_l^{(\dagger)} \qquad\qquad \hat{c}_{l,\downarrow}^{(\dagger)} \leftrightarrow \hat{d}_l^{(\dagger)}$$

$$\mathcal{H}_0 = U \cdot \sum_l \hat{c}_l^\dagger \hat{c}_l \hat{d}_l^\dagger \hat{d}_l + \sum_l \varepsilon_l \hat{c}_l^\dagger \hat{c}_l \sum_l \varepsilon_l \hat{d}_l^\dagger \hat{d}_l$$

$$\hat{V} = -J \cdot \sum_{\langle l,m \rangle} \left(\hat{c}_l^\dagger \hat{c}_m + \hat{c}_m^\dagger \hat{c}_l + \hat{d}_l^\dagger \hat{d}_m + \hat{d}_m^\dagger \hat{d}_l \right)$$