Chapter 6

Numerical Results

6.0.1 2DQ-Majorana shifting the second QD-majorana hopping term t_2

$U_1 = U_2 = -2\varepsilon_{d1} = -2\varepsilon_{d2} = 0.5, \Gamma_1 = \Gamma_2, t_1 = 0.02$

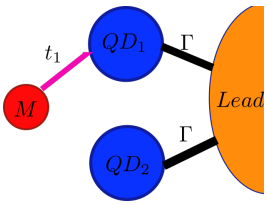


Figure 6.1

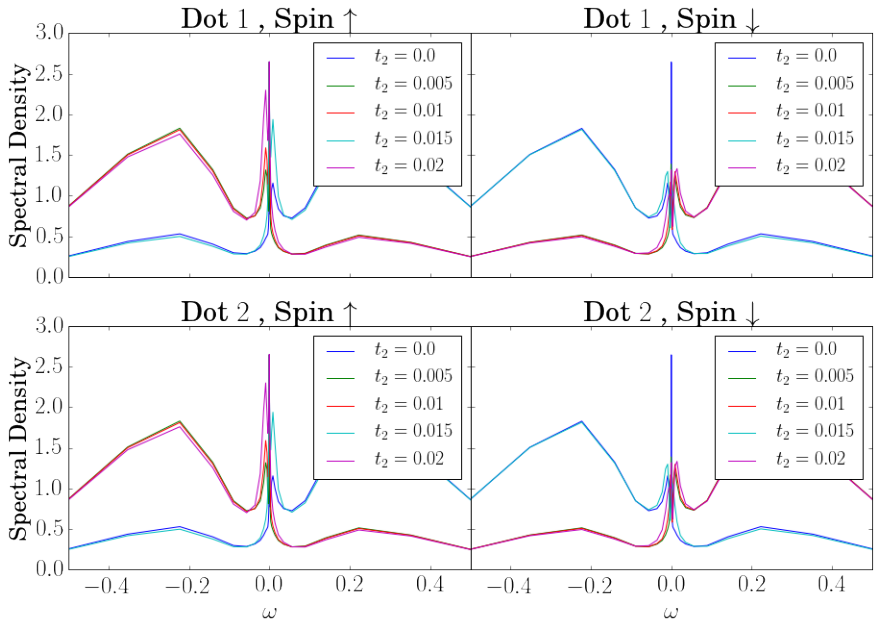
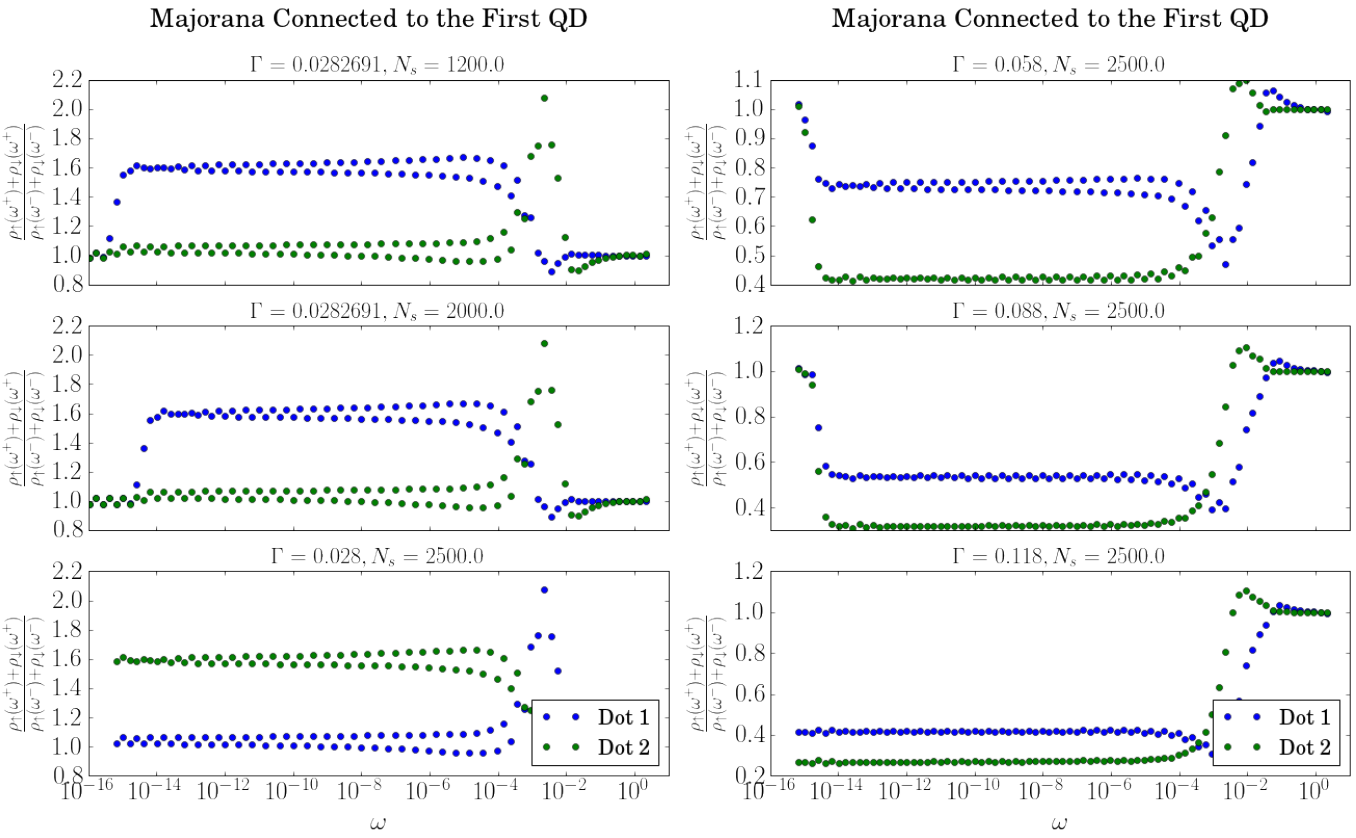


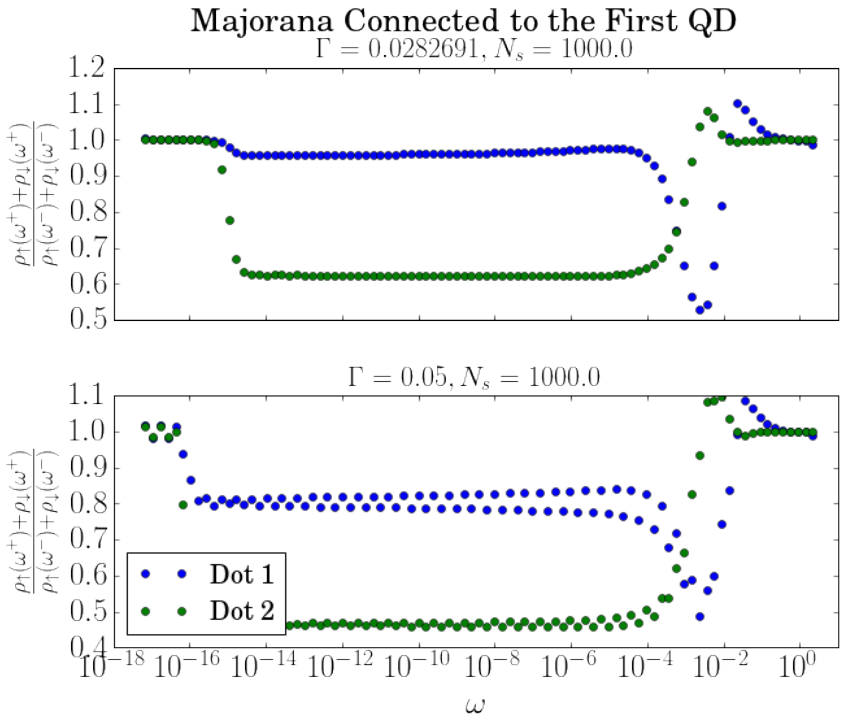
Figure 6.2



(a) (b)

Figure 6.3

Full Fock Space



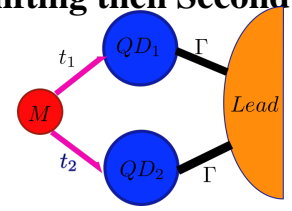
(a)

Figure 6.4

6.0.2 2DQ-Majorana shifting symmetrically the QD-majorana hopping term $t_1 = t_2$

$U_1 = U_2 = -2\varepsilon_{d1} = -2\varepsilon_{d2} = 0.5, \Gamma_1 = \Gamma_2$

6.1 2DQ-Majorana shifting then Second QD's gate-voltage.



We start with the parameters $U_1 = U_2 = -2\varepsilon_{d1} = -2\varepsilon_{d2} = 0.5$, $\Gamma_1 = \Gamma_2$, $t_1 = t_2 = 0.02$, so that both QDs are symmetrically connected to both, the majorana and the leads. We observe that both QDs exhibit a $\frac{1}{2}$-peak Majorana signature in the spin-down DOS at the Fermi energy ($\rho_{i\downarrow}(0) = \frac{1}{2}\rho_{i\uparrow}(0)$, $i \in 1,2$). Hence, we may conclude that the majorana has leaked into the two QDs at this stage.

In Figure 6.5 the energy of the second dot ε_{d2} is scaled up to -0.05. The result is an inflation of the DOS in the second QD for both spins which totally destroys the majorana signature . The situation is different in the first QD, in which the DOS is slightly disturbed. If we compare directly the DOS at the Fermi energy (See Figure 6.6b on page 25) we observe that the reason $\frac{\rho_{i\uparrow}(0)}{\rho_{i\downarrow}(0)}$ starts at 2 for both QDs in the symmetric case ($\varepsilon_{d2} = -0.25$), and then when ε_{d2} scales up it increases for the first dot ($i = 1$) and decreases for the second dot ($i = 2$). This implies that the majorana signature $\frac{\rho_{i\uparrow}(0)}{\rho_{i\downarrow}(0)} = 2$ turns even stronger in the first dot, so that the we are actually inducing the Majorana to preferably tunnel to the first dot in despite of the second.

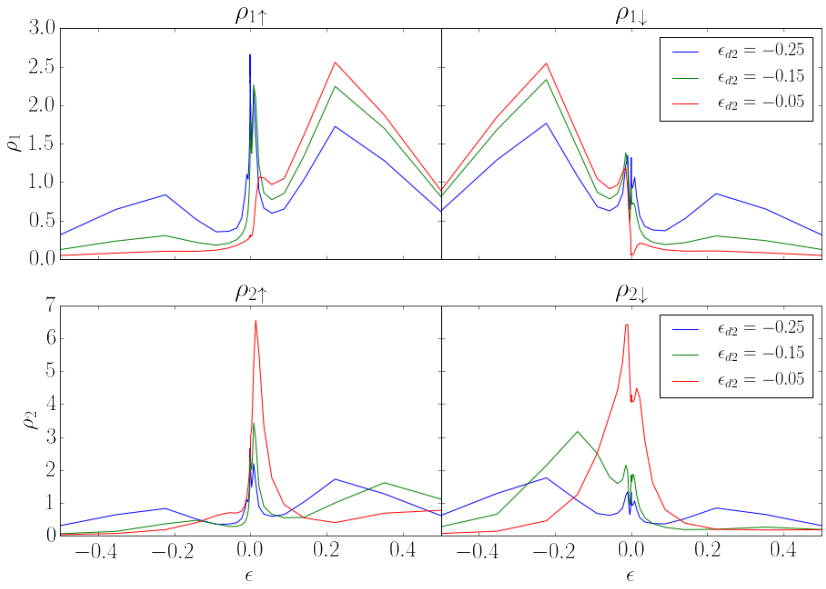


Figure 6.5: NRG calculations of the zero-temperature LDOS for $U_1 = U_2 = -2\varepsilon_{d1} = 0.5$, $\Gamma_1 = \Gamma_2$, $t_1 = t_2 = 0.02$ with ε_{d2} between -0.25 and -0.05.

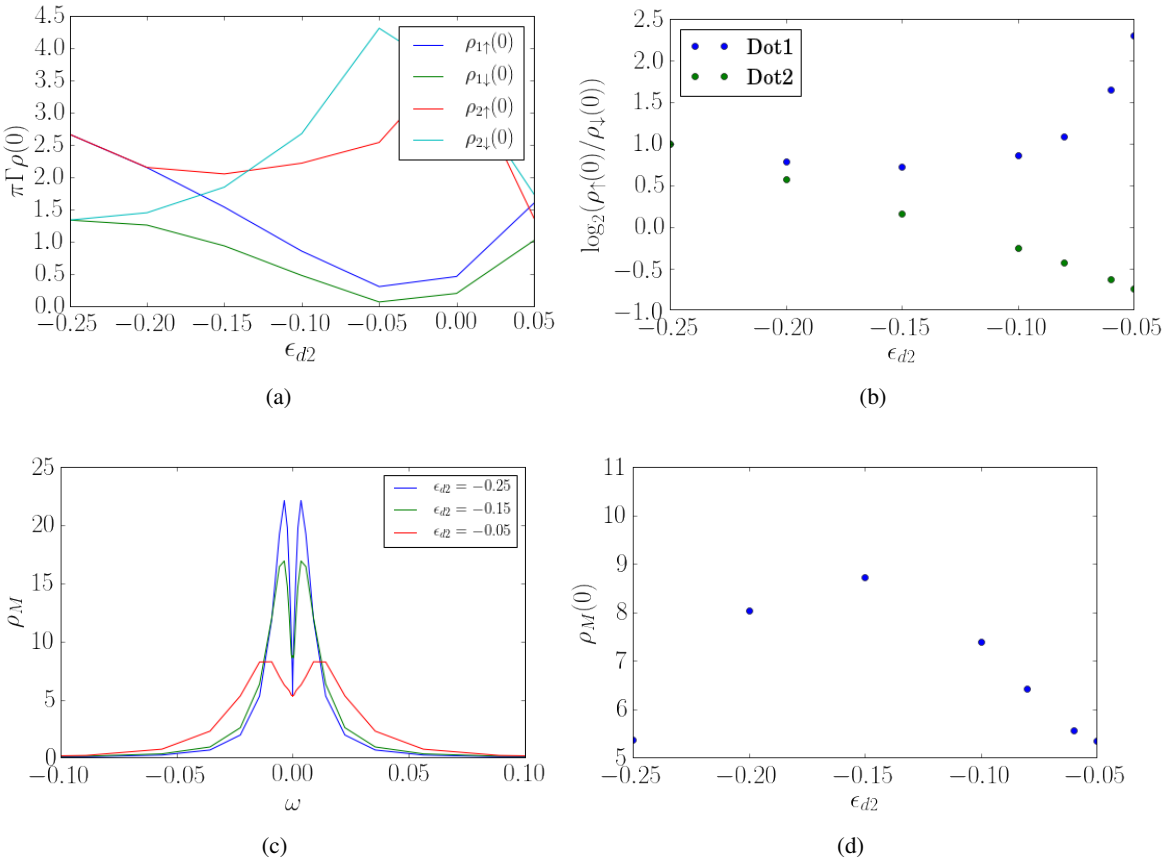

$\pi\Gamma\rho(0)$
$\rho_{1\uparrow}(0)$
$\rho_{1\downarrow}(0)$
$\rho_{2\uparrow}(0)$
$\rho_{2\downarrow}(0)$
ϵ_{d2}
(a)
$\log_2(\rho_\uparrow(0)/\rho_\downarrow(0))$
Dot1
Dot2
ϵ_{d2}
(b)
ρ_M
$\epsilon_{d2} = -0.25$
$\epsilon_{d2} = -0.15$
$\epsilon_{d2} = -0.05$
ω
(c)
$\rho_M(0)$
ϵ_{d2}
(d)

Figure 6.6