Figure 1

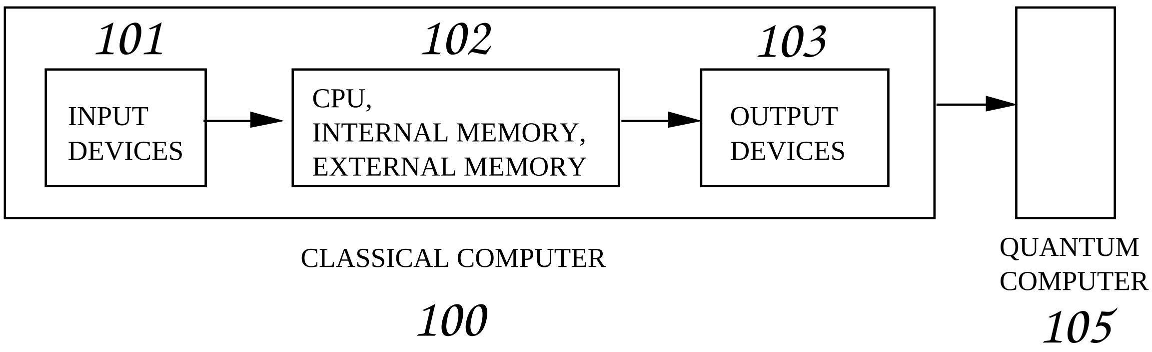
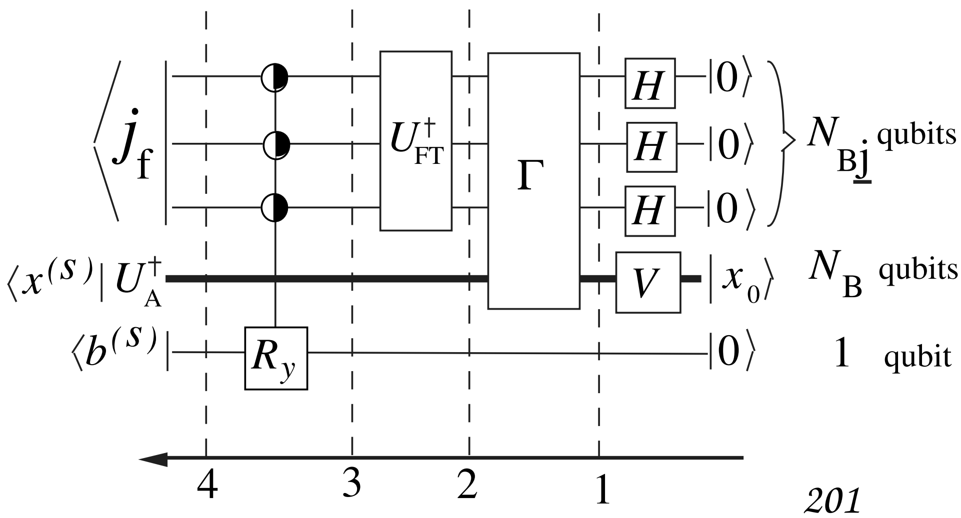

101
102
103
INPUT DEVICES
CPU,
INTERNAL MEMORY,
EXTERNAL MEMORY
OUTPUT DEVICES
CLASSICAL COMPUTER
100
QUANTUM COMPUTER
105

Figure 2

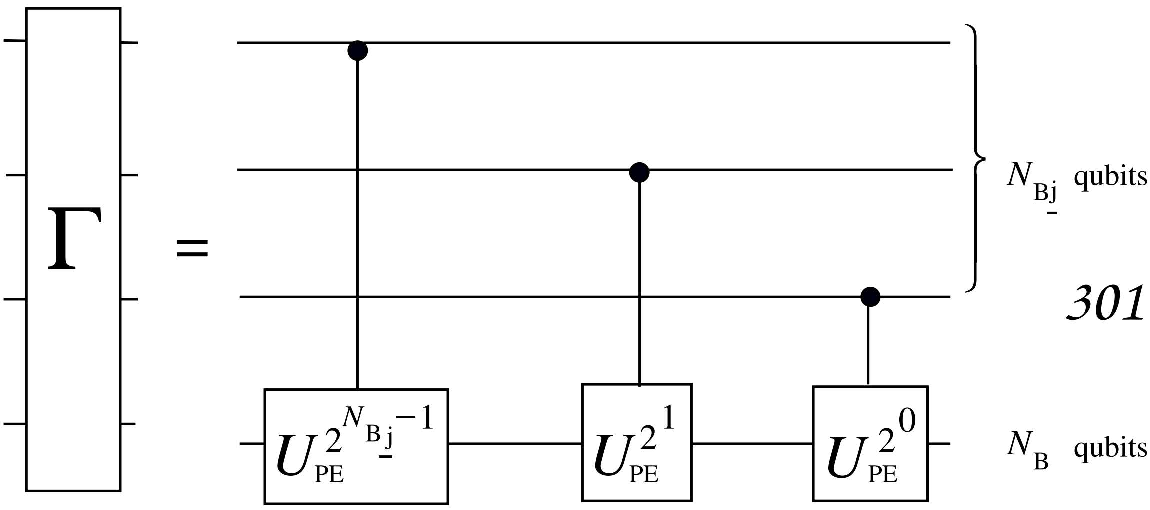


201

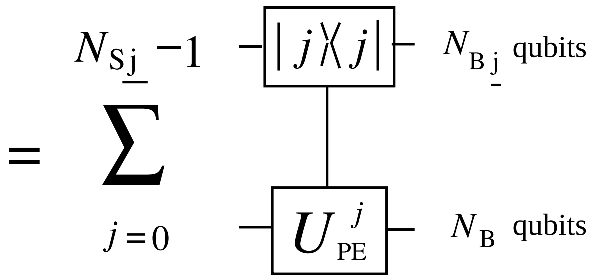
$$\mu(x_0) \overset{\text{def}}{=} \langle x_0 | V^\dagger f(A) V | x_0 \rangle \qquad 202$$

$$\mu(x_0) = \frac{1}{\gamma N_{sam}} \sum_{s=1}^{N_{sam}} \delta_0^{b^{(s)}} \qquad 203$$

Figure 3



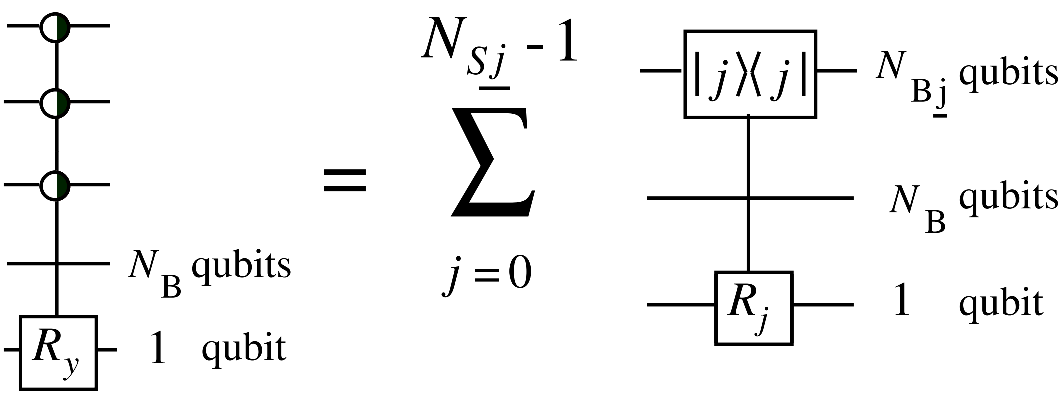
301



302

$$U_{PE} = e^{i A \Delta t}$$ 303

Figure 4



401

$$R_j = \begin{bmatrix} c_j & -s_j \\ s_j & c_j \end{bmatrix}$$

402

$$c_j = \sqrt{\gamma f\left(\frac{2\pi j}{\Delta t \; N_{S\underline{j}}}\right)}$$

403

$$s_j = \sqrt{1 - c_j^2}$$

404

Figure 5

Figure 6

$$\langle y | U_\Omega | x \rangle = \langle y | \hat{\Omega} = \Omega_x \rangle, \quad Z = \mathrm{tr}(e^{-\beta H})$$ *601*

(a)

$$V = U_\Omega , \quad A = \rho , \quad f(\xi) = \xi$$ *602*

$$\mu(x) = \langle x | U_\Omega^\dagger \rho U_\Omega | x \rangle$$ *603*

$$\mathrm{tr}(\Omega \rho) = \frac{1}{N_{sam}} \sum_{s=1}^{N_{sam}} \Omega_{x^{(s)}}$$ *604*

(b)

$$V = U_\Omega , \quad A = H, \quad f(\xi) = e^{-\beta\xi}$$ *605*

$$\mu(x) = \langle x | U_\Omega^\dagger e^{-\beta H} U_\Omega | x \rangle$$ *606*

$$\mathrm{tr}(\Omega \rho) = \frac{1}{N_{sam}} \sum_{s=1}^{N_{sam}} \Omega_{x^{(s)}} , \text{ where } \rho = \frac{e^{-\beta H}}{Z}$$ *607*

(c)

$$V = 1, \quad A = H, \quad f(\xi) = e^{-\beta\xi}$$ *608*

$$\mu(x) = \langle x | e^{-\beta H} | x \rangle$$ *609*

$$\check{P}(x) = \frac{1}{N_{sam}} \sum_{s=1}^{N_{sam}} \delta_x^{x^{(s)}} , \quad \check{Z} = \frac{1}{N_{sam}} \sum_{s=1}^{N_{sam}} \frac{\mu(x^{(s)})}{\check{P}(x^{(s)})} \approx Z$$

610 *611*