Superconducting Circuits - Equation Glossary

Instantaneous Energy

$$E(t) = \int_{-\infty}^{t} V(t')I(t')\,\mathrm{d}t'$$

Circuit Flux (Faraday's Law)

$$\phi(t) = \int_{-\infty}^{t} V(t')\mathrm{d}t'$$

Voltage-Inductance-Current Relation

$$V = L\frac{dI}{dt} \sim \hat{n} \sim \hat{q} = -iQ_{zpf}(\hat{a} - \hat{a}^\dagger)$$

Zero Point Charge Fluctuation

$$Q_{zpf} = \sqrt{\frac{\hbar}{2Z}}$$

Flux-Inductance-Current Relation

$$\Phi = LI \sim (\hat{a} + \hat{a}^\dagger)$$

Current-Capacitance-Voltage Relation

$$I = C\frac{dV}{dt}$$

LC-Circuit Impedance

$$Z = \sqrt{\frac{L}{C}}$$

Admittance-Impedance relation

$$Y(\omega) = Z^{-1}(\omega)$$

Josephson Relation #1

$$I(t) = I_c \sin(\varphi(t))$$

Josephson Relation #2

$$\frac{\partial \varphi}{\partial t} = \frac{2eV(t)}{\hbar}$$

Purcell limit on qubit lifetime

$$T_1 = Q_{qb}/\omega_{qb}$$

Cooper-Pair Box Hamiltonian

$$H_{CPB} = 4E_C(\hat{n} - n_g)^2 - E_J\cos(\hat{\varphi}))$$