General theory

Saturday, 2 April 2022 13:35

in SI

$$I = I_c \sin\theta + \frac{\hbar}{2e} R^{-1} \dot{\theta} + \frac{\hbar}{2e} C \ddot{\theta} + \eta$$

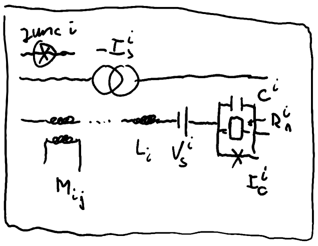
$$M(I - I_s) = 0$$

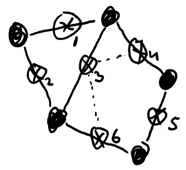
$$V = \frac{\hbar}{2e} \dot{\theta} + L \dot{I} + V_s$$

$$AV + \dot{\Phi}_e = 0$$

$$\theta_s \equiv \frac{2e}{\hbar} \int_0^t V_s(t') \partial t'$$

$$A\left[\frac{\hbar}{2e}\theta + LI + \frac{\hbar}{2e}\theta_s\right] + \Phi_e = 2\pi z$$





L	1	2	3	4	5	6
1	0	0	0	0	0	0
2	0	1	0	0	0	0
3	0	0	2.7	0.2	0	0.1
4	0	0	0.2	2.1	0	0
5	0	0	0	0	4.0	0
6	0	0	0.1	0	0	0

$$R = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2.5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.5 \end{bmatrix}$$

R I_c C L → matrices

→ diagonal matrices

	I_c	R_n	C	I_s	V_s
1	1	1	0	0	~2.3
2	2	2	0	0	0
3	1.5	1.5	3.2	1.2	0
4	0.5	2.5	0	0	0
5	0	2	1	1.2	0
6	0	0.5	2	0	0

Normalized units

Normalizing scalars I_0, R_0, a_0

$V \rightarrow I_0 R_0$

$t \rightarrow \Phi_0 / (2\pi I_0 R_0)$

$E \rightarrow \mathcal{E}_{J0} \equiv \frac{1}{2\pi} \Phi_0 I_0$

$L \rightarrow E_{J0} I_0^{-2} = \Phi_0 / (2\pi I_0)$

$\Phi \rightarrow \Phi_0$

$C \rightarrow \Phi_0 / (2\pi I_0 R_0^2)$

Other quantities in normalized units

	SI.	normalized	
E_J	$\frac{1}{2\pi} \Phi_0 I_c$	I_c	
t_J	$\Phi_0 / (2\pi I_c R)$	$(I_c R)^{-1}$	
t_c	RC	RC	
t_L	L/R	L/R	
β_c	$2\pi R^2 C I_c / \Phi_0$	$R^2 I_c C$	$= t_c / t_J$
β_L	$2\pi L I_c / \Phi_0$	$I_c L$	$= t_L / t_J$

$$I = I_c \sin\theta + R^{-1}\dot{\theta} + C\ddot{\theta} + \eta$$

$$M(I - I_s) = 0 \quad \leftarrow \text{KCL}$$

$$V = \dot{\theta} + L\dot{I} + V_s$$

$$AV + 2\pi \dot{\Phi}_e = 0 \quad \leftarrow \text{KVL}$$

$$\theta_s \equiv \int_0^t V_s(t') \partial t'$$

IKVL(z)

$$A[\theta + LI + \theta_s] + 2\pi\Phi_e = 2\pi z$$