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1.2. $y^{(n)} = g_1(t, y, \dot{y}, y \cdots y^{(n-1)}, u) + g_2(t, y, \dot{y}, \cdots y^{(n-2)})\dot{u}$

令 $x_n = y^{(n-1)} - g_2(t, y, \dot{y}, \cdots y^{(n-2)})u$

$x_1 = y$, $x_2 = \dot{y}$, $x_3 = y^{(2)}$, $\cdots$ $x_{n-1} = y^{(n-2)}$.

$\because \dot{x}_n = y^{(n)} - g_2(t, x_1, \cdots x_{n-1})\dot{u} - (\frac{\partial g_2}{\partial t} + \frac{\partial g_2}{\partial t} \cdot \dot{x}_1 + \cdots + \frac{\partial g_2}{\partial x_{n-1}}\dot{x}_{n-1})u$

$\therefore \dot{x}_n = g_1(t, x_1, \cdots x_{n-1}, x_n + g_2 \cdot u, u) - (\frac{\partial g_2}{\partial t} + \frac{\partial g_2}{\partial x_1} x_2 + \cdots + \frac{\partial g_2}{\partial x_{n-1}}(x_n + g_2 u))u$

$\therefore$ 状态模型为

$\dot{x}_1 = x_2$

$\dot{x}_2 = x_3$

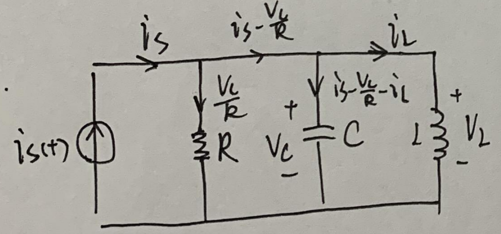
$\vdots$

$\dot{x}_{n-1} = x_n + g_2(t, x_1, x_2 \cdots, x_{n-1})u$

$\dot{x}_n = g_1(t, x_1, \cdots, x_{n-1}, x_n + g_2 u, u) - (\frac{\partial g_2}{\partial t} + \frac{\partial g_2}{\partial x_1} x_2 + \cdots + \frac{\partial g_2}{\partial x_{n-1}}(x_n + g_2 u))u$

$y = x_1$

1.9.



$i_L = I_0 \sin k\phi_L$.

(a). 令 ϕ_L、v_c 为状态变量.

即 $x_1 = \phi_L$. $x_2 = v_c$.

$\therefore \dot{x}_1 = \dot{\phi}_L = V_L = v_c = x_2$.

$\dot{x}_2 = \dot{v}_c = i_c \cdot \frac{1}{C} = \frac{1}{C}[i_s - \frac{V_c}{R} - i_L]$

$\therefore \dot{x}_2 = \frac{1}{C}[i_s - I_0 \sin k x_1 - \frac{1}{R} x_2]$.

(b). $x_1 = i_L$. $x_2 = v_c$.

$\dot{x}_1 = \dot{i}_L = I_0 k \cos k\phi_L \cdot \dot{\phi}_L$ 将 $\cos k\phi_L$ 再用 i_L、v_c 表示显然更难.

1.10. $i_L = L\cdot\phi_L + \mu\phi_L^3$.

(a). $x_1 = \phi_L$, $x_2 = v_C$.

$\dot{x}_1$ 与 1.9 相同, $\dot{x}_1 = x_2$.

$\dot{x}_2 = \dot{v}_C = \frac{1}{C}[i_s - i_L - \frac{v_C}{R}]$. $i_L = L\phi_L + \mu\phi_L^3 = Lx_1 + \mu x_1^3$

$\therefore \dot{x}_2 = \frac{1}{C}[i_s - Lx_1 - \mu x_1^3 - \frac{1}{R}x_2]$.

(b). $i_s = 0$. 若 $x_2 = v_C = 0$. 则 $v_L = 0$. 则 $i_L = L\cdot\phi_L + \mu\phi_L^3 = 0$

$\because L.\mu$ 为常数

$\therefore$ 当且仅当 $\phi_L = 0$. 即 $x_1 = 0$ 时为平衡点.