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1.2(1) $i = 5u + u^2 - 0.5u^3$

当 $U_Q = 1V$ 时 $u = 1 + 0.5\cos\omega t$

$G = \frac{I_Q}{U_Q} = \frac{5 + 1 - 0.5 \times 1}{1} = 5.5 mS$

$g = \frac{\partial i}{\partial u} \bigg|_{u=U_Q} = (5 + 2u - 0.5 \times 3u^2) \bigg|_{u=1} = 5.5 mS$

$G_{m1} = \frac{I_1}{U_i}$

$i = 5 \times (1 + 0.5\cos\omega t) + (1 + 0.5\cos\omega t)^2 - 0.5 \times (1 + 0.5\cos\omega t)^3$
 $= 5.5 + 2.75\cos\omega t - 0.125\cos^2\omega t - 0.0625\cos^3\omega t$

$\therefore I_1 = 2.75 - 0.0625 \times \frac{3}{4} = 2.703125 mA$

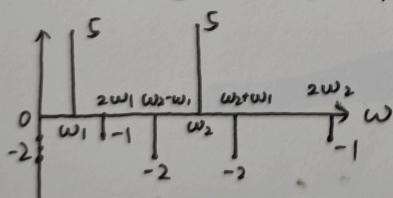
$G_{m1} = \frac{I_1}{U_i} = \frac{2.703125}{0.5} = 5.40625 mS$

1.3(3) $i = 5u - 2u^2$, $u = \cos 2\pi \times 10^3 t + \cos 2\pi \times 10^6 t (V)$

设 $u = \cos\omega_1 t + \cos\omega_2 t$

$i = 5 \times (\cos\omega_1 t + \cos\omega_2 t) - 2 \times (\cos\omega_1 t + \cos\omega_2 t)^2$
 $= 5\cos\omega_1 t + 5\cos\omega_2 t - 2\cos^2\omega_1 t - 4\cos\omega_1 t \cos\omega_2 t - 2\cos^2\omega_2 t$
 $= 5\cos\omega_1 t + 5\cos\omega_2 t - (1 + \cos 2\omega_1 t) - 4 \times \frac{1}{2} [\cos(\omega_2 - \omega_1)t + \cos(\omega_2 + \omega_1)t] - (1 + \cos 2\omega_2 t)$
 $= 5\cos\omega_1 t + 5\cos\omega_2 t - \cos 2\omega_1 t - \cos 2\omega_2 t - 2\cos(\omega_2 - \omega_1)t - 2\cos(\omega_2 + \omega_1)t - 2$

0: -2 $\omega_1: 5$ $\omega_2 - \omega_1: -2$ $2\omega_1: -1$
 $\omega_2: 5$ $\omega_2 + \omega_1: -2$ $2\omega_2: -1$



其中 $\omega_1 = 2\pi \times 10^3$
 $\omega_2 = 2\pi \times 10^6$

1.4(b). $f = \frac{1}{2\pi\sqrt{LC}}$ $C = C_j \# C_1 = C_j + C_1 = 20 + 20 \times (1 + 0.25u)^{-0.5} (pF)$

$L = 10 \mu H$

$\therefore f = \frac{1}{2\pi\sqrt{10^{-5} \times [20 + 20 \times (1 + 0.25u)^{-0.5}] \times 10^{-12}}}$
 $= \frac{10^8}{2\pi} \times \frac{1}{\sqrt{2 + 2 \times (1 + 0.25u)^{-0.5}}}$

$u = 1, f = 8.176 \times 10^6 Hz$

$u = 3, f = 8.493 \times 10^6 Hz$

