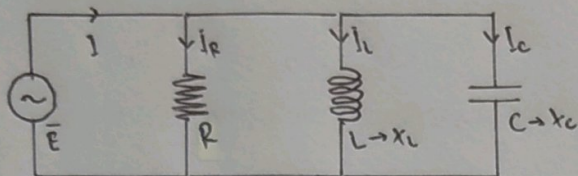


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# TUGAS PENGGANTI WORKSHOP RPP RANGKAIAN RESONANSI PARALEL

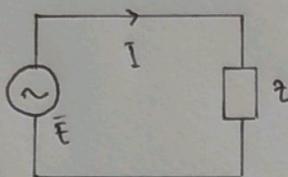


Diket :  $R = 10 \Omega$

$L = 40 \text{ mH} = 40 \cdot 10^{-3} \text{ H}$

$C = 0,633 \mu\text{F} = 633 \cdot 10^{-9} \text{ F}$

$E = 2 \text{ volt}$



No	f (Hz)	$X_L (\Omega)$	$X_C (\Omega)$	$Z (\Omega)$	I (mA)
1	500	$j125,6$	$-j503,11$	$1166,67$	12
2	600	$j150,12$	$-j419,26$	$232,56$	8,6
3	700	$j175,84$	$-j359,07$	$333,33$	6
4	800	$j200,96$	$-j314,45$	$476,2$	4,2
5	900	$j226,08$	$-j279,5$	$769,23$	2,6
6	1000	$j251,2$	$-j251,56$	1000	2
7	1100	$j276,32$	$-j227,7$	$769,23$	2,6
8	1200	$j301,4$	$-j209,63$	$555,5$	3,6
9	1300	$j326,56$	$-j193,5$	$434,78$	4,6
10	1400	$j351,7$	$-j179,7$	$333,3$	6
11	1500	$j376,8$	$-j169,7$	$285,71$	7

→ Nilai frekuensi resonansi berdasarkan nilai arus terkecil

$$\bullet f_r (\text{Hz}) = 1000 \text{ Hz} \dots (1)$$

$$\bullet f_{rT} = \frac{1}{2\pi \cdot \sqrt{L \cdot C}}$$

$$\bullet \% \text{ Error} = \frac{|(1) - (2)|}{(1)} \times 100\%$$

$$= \frac{1}{2 \cdot 3,14 \sqrt{40 \cdot 10^{-3} \cdot 633 \cdot 10^{-9}}}$$

$$= \frac{|1000 - 1000,71|}{1000} \cdot 100\%$$

$$= 1000,71 \text{ Hz} \dots (2)$$

$$= 0,071 \%$$



$$1. f = 500 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j\omega L \\ &= j \cdot 2\pi f \cdot L \\ &= j \cdot 2 \cdot 3,14 \cdot 500 \cdot 40 \cdot 10^{-3} \\ &= j125,6 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{\omega C} \\ &= -j \frac{1}{2\pi f \cdot C} \\ &= -j \frac{1}{2 \cdot 3,14 \cdot 500 \cdot 633 \cdot 10^{-9}} \\ &= -j503,11 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet Z &= \frac{1}{Y} \\ &= \frac{1}{\sqrt{G^2 + (B_L - B_C)^2}} \end{aligned}$$

$$\begin{aligned} G &= \frac{1}{R} & B_L &= \frac{1}{X_L} & B_C &= \frac{1}{X_C} \\ &= \frac{1}{10^3 \, \Omega} & &= \frac{1}{125,6 \, \Omega} & &= \frac{1}{503,11 \, \Omega} \\ &= 10^{-3} \, \text{S} & &= 0,008 \, \text{S} & &= 0,002 \, \text{S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,008 - 0,002)^2}} \\ &= \frac{1}{0,006 \, \text{S}} = 166,67 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet I &= \frac{E}{Z} \\ &= \frac{2 \, \text{V}}{166,67 \, \Omega} = 12 \, \text{mA} \end{aligned}$$

$$2. f = 600 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 600 \cdot 40 \cdot 10^{-3} \\ &= j150,12 \, \Omega \end{aligned}$$

$$\rightarrow f = 600 \text{ Hz}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 600 \cdot 633 \cdot 10^{-9}} \\ &= -j419,26 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \, \text{S} & B_L &= \frac{1}{150,12 \, \Omega} & B_C &= \frac{1}{419,26 \, \Omega} \\ & & &= 0,0066 \, \text{S} & &= 0,0024 \, \text{S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,0066 - 0,0024)^2}} \\ &= \frac{1}{0,0043 \, \text{S}} = 232,56 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \, \text{V}}{232,56 \, \Omega} = 8,6 \, \text{mA}$$

$$3. f = 700 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 700 \cdot 40 \cdot 10^{-3} \\ &= j175,84 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 700 \cdot 633 \cdot 10^{-9}} \\ &= -j359,07 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \, \text{S} & B_L &= \frac{1}{175,84 \, \Omega} & B_C &= \frac{1}{359,07 \, \Omega} \\ & & &= 0,0057 \, \text{S} & &= 0,0028 \, \text{S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,0057 - 0,0028)^2}} \\ &= \frac{1}{0,003 \, \text{S}} = 333,33 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \, \text{V}}{333,33 \, \Omega} = 6 \, \text{mA}$$



$$4. f = 800 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 800 \cdot 40 \cdot 10^{-3} \\ &= j 200,96 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 800 \cdot 633 \cdot 10^{-9}} \\ &= -j 314,45 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \text{ S} \quad B_L = \frac{1}{200,96 \, \Omega} \quad B_C = \frac{1}{314,45 \, \Omega} \\ &= 0,005 \text{ S} \quad = 0,0032 \text{ S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,005 - 0,0032)^2}} \\ &= \frac{1}{0,0021 \text{ S}} = 476,2 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \text{ V}}{476,2 \, \Omega} = 4,2 \text{ mA}$$

$$5. f = 900 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 900 \cdot 40 \cdot 10^{-3} \\ &= j 226,08 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 900 \cdot 633 \cdot 10^{-9}} \\ &= -j 279,5 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \text{ S} \quad B_L = \frac{1}{226,08 \, \Omega} \quad B_C = \frac{1}{279,5 \, \Omega} \\ &= 0,0044 \text{ S} \quad = 0,0036 \text{ S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,0044 - 0,0036)^2}} \\ &= \frac{1}{0,0013 \text{ S}} = 769,23 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \text{ V}}{769,23 \, \Omega} = 2,6 \text{ mA}$$

$$6. f = 1000 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 1000 \cdot 40 \cdot 10^{-3} \\ &= j 251,2 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 1000 \cdot 633 \cdot 10^{-9}} \\ &= -j 251,56 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \text{ S} \quad B_L = \frac{1}{251,2 \, \Omega} \quad B_C = \frac{1}{251,56 \, \Omega} \\ &= 0,004 \text{ S} \quad = 0,004 \text{ S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,004 - 0,004)^2}} \\ &= \frac{1}{10^{-3} \text{ S}} = 1000 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \text{ V}}{1000 \, \Omega} = 2 \text{ mA.} \quad (\checkmark)$$

$$7. f = 1100 \text{ Hz}$$

$$\begin{aligned} \bullet X_L &= j \cdot 2 \cdot 3,14 \cdot 1100 \cdot 40 \cdot 10^{-3} \\ &= j 216,32 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet X_C &= -j \frac{1}{2 \cdot 3,14 \cdot 1100 \cdot 633 \cdot 10^{-9}} \\ &= -j 227,7 \, \Omega \end{aligned}$$

$$\begin{aligned} \bullet G &= 10^{-3} \text{ S} \quad B_L = \frac{1}{216,32 \, \Omega} \quad B_C = \frac{1}{227,7 \, \Omega} \\ &= 0,0046 \text{ S} \quad = 0,0044 \text{ S} \end{aligned}$$

$$\begin{aligned} Z &= \frac{1}{\sqrt{(10^{-3})^2 + (0,0046 - 0,0044)^2}} \\ &= \frac{1}{0,0013 \text{ S}} = 769,23 \, \Omega \end{aligned}$$

$$\bullet I = \frac{2 \text{ V}}{769,23 \, \Omega} = 2,6 \text{ mA}$$



$$8. f = 1200 \text{ Hz}$$

$$\bullet X_L = j \cdot 2 \cdot 3,14 \cdot 1200 \cdot 40 \cdot 10^{-3} \\ = j 301,4 \, \Omega$$

$$\bullet X_C = -j \frac{1}{2 \cdot 3,14 \cdot 1200 \cdot 633 \cdot 10^{-9}} \\ = -j 209,63 \, \Omega$$

$$\bullet \bar{G} = 10^{-3} \text{ S} \quad B_L = \frac{1}{301,4 \, \Omega} \quad B_C = \frac{1}{209,63 \, \Omega} \\ = 0,0033 \text{ S} \quad = 0,0048 \text{ S}$$

$$Z = \frac{1}{\sqrt{(10^{-3})^2 + (0,0033 - 0,0048)^2}} \\ = \frac{1}{0,0018 \text{ S}} = 555,5 \, \Omega$$

$$\bullet I = \frac{2 \text{ V}}{555,5 \, \Omega} = 3,6 \text{ mA}$$

$$9. f = 1300 \text{ Hz}$$

$$\bullet X_L = j \cdot 2 \cdot 3,14 \cdot 1300 \cdot 40 \cdot 10^{-3} \\ = j 326,56 \, \Omega$$

$$\bullet X_C = -j \frac{1}{2 \cdot 3,14 \cdot 1300 \cdot 633 \cdot 10^{-9}} \\ = -j 193,7 \, \Omega$$

$$\bullet \bar{G} = 10^{-3} \text{ S} \quad B_L = \frac{1}{326,56 \, \Omega} \quad B_C = \frac{1}{193,7 \, \Omega} \\ = 0,0031 \text{ S} \quad = 0,0051 \text{ S}$$

$$Z = \frac{1}{\sqrt{(10^{-3})^2 + (0,0031 - 0,0051)^2}} \\ = \frac{1}{0,0023 \text{ S}} = 434,78 \, \Omega$$

$$\bullet I = \frac{2 \text{ V}}{434,78 \, \Omega} = 4,6 \text{ mA}$$

$$10. f = 1400 \text{ Hz}$$

$$\bullet X_L = j \cdot 2 \cdot 3,14 \cdot 1400 \cdot 40 \cdot 10^{-3} \\ = j 351,7 \, \Omega$$

$$\bullet X_C = -j \frac{1}{2 \cdot 3,14 \cdot 1400 \cdot 633 \cdot 10^{-9}} \\ = -j 179,7 \, \Omega$$

$$\bullet \bar{G} = 10^{-3} \text{ S} \quad B_L = \frac{1}{351,7 \, \Omega} \quad B_C = \frac{1}{179,7 \, \Omega} \\ = 0,0028 \text{ S} \quad = 0,0056 \text{ S}$$

$$Z = \frac{1}{\sqrt{(10^{-3})^2 + (0,0028 - 0,0056)^2}} \\ = \frac{1}{0,003 \text{ S}} = 333,3 \, \Omega$$

$$\bullet I = \frac{2 \text{ V}}{333,3 \, \Omega} = 6 \text{ mA}$$

$$11. f = 1500 \text{ Hz}$$

$$\bullet X_L = j \cdot 2 \cdot 3,14 \cdot 1500 \cdot 40 \cdot 10^{-3} \\ = j 376,8 \, \Omega$$

$$\bullet X_C = -j \frac{1}{2 \cdot 3,14 \cdot 1500 \cdot 633 \cdot 10^{-9}} \\ = -j 169,7 \, \Omega$$

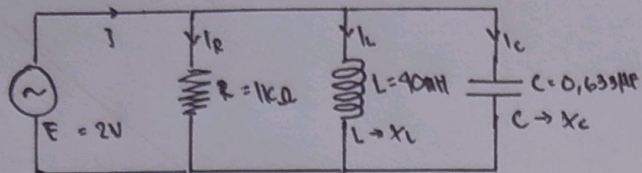
$$\bullet \bar{G} = 10^{-3} \text{ S} \quad B_L = \frac{1}{376,8 \, \Omega} \quad B_C = \frac{1}{169,7 \, \Omega} \\ = 0,0026 \text{ S} \quad = 0,006 \text{ S}$$

$$Z = \frac{1}{\sqrt{(10^{-3})^2 + (0,0026 - 0,006)^2}} \\ = \frac{1}{0,0035 \text{ S}} = 285,71 \, \Omega$$

$$\bullet I = \frac{2 \text{ V}}{285,71 \, \Omega} = 7 \text{ mA}$$



2. Menghitung L, C untuk menghitung Faktor Kualitas



Rangkaian  
Resonansi paralel.

No	f (kHz)	L (mH)	C (μF)	Q
1	1 kHz	40	0,63	3,995
2	2 kHz	20	0,316	3,968
3	3 kHz	13	0,21	3,956
4	4 kHz	10	0,157	3,943
5	5 kHz	8	0,126	3,956

\* Perhitungan : (Pada saat kondisi resonansi).

$$I_r = \frac{E}{R}$$

$$= \frac{2 \text{ volt}}{1000 \Omega} = 2 \text{ mA}$$

$$I_L = -j \cdot \frac{R}{\omega \cdot L} \cdot I$$

$$= -j \cdot \frac{R \cdot I}{2\pi \cdot f \cdot L}$$

$$= -j \cdot \frac{1000 \cdot 0,002}{2 \cdot 3,14 \cdot 1000 \cdot 0,040} = -j 0,0079 \text{ A.}$$

$$I_C = j \cdot \omega \cdot C \cdot R \cdot I$$

$$= j \cdot 2\pi \cdot f \cdot C \cdot R \cdot I$$

$$= j \cdot 2 \cdot 3,14 \cdot 1000 \cdot 0,633 \cdot 10^{-6} \cdot 1000 \cdot 0,002$$

$$= j \cdot 0,00795 \text{ A.}$$

$$I_C \cong I_L \text{ "saat resonansi"}$$



$$1. f = 1000 \text{ Hz}$$

$$*L = \frac{-j \cdot R \cdot \bar{I}}{\omega \cdot I_L}$$

$$= \frac{-j \cdot R \cdot \bar{I}}{2\pi \cdot f \cdot I_L}$$

$$= \frac{-j \cdot 1000 \cdot 0,002}{2,3,14 \cdot 1000 \cdot -j 0,0079}$$

$$= 40 \text{ mH}$$

$$*C = \frac{I_C}{j \cdot \omega \cdot R \cdot \bar{I}}$$

$$= \frac{I_C}{j \cdot 2\pi \cdot f \cdot R \cdot \bar{I}}$$

$$= \frac{j \cdot 0,00795}{j \cdot 2,3,14 \cdot 1000 \cdot 1000 \cdot 0,002}$$

$$= 0,633 \mu\text{F}$$

$$*Q = \frac{R}{\omega \cdot L} = \omega \cdot C \cdot R = \frac{I_L}{\bar{I}} = \frac{I_C}{\bar{I}}$$

$$Q = \omega \cdot C \cdot R$$

$$= 2\pi \cdot f \cdot C$$

$$= 2,3,14 \cdot 1000 \cdot 0,633 \cdot 10^{-6} \cdot 1000$$

$$= 3,975$$

$$2. f = 2000 \text{ Hz}$$

$$*L = \frac{-j \cdot 1000 \cdot 0,002}{2,3,14 \cdot 2000 \cdot -j 0,0079}$$

$$= 20 \text{ mH}$$

$$*C = \frac{j \cdot 0,00795}{j \cdot 2,3,14 \cdot 2000 \cdot 1000 \cdot 0,002}$$

$$= 0,316 \mu\text{F}$$

$$*Q = 2,3,14 \cdot 2000 \cdot 0,31 \cdot 10^{-6} \cdot 1000$$

$$= 3,893$$

$$3. f = 3000 \text{ Hz}$$

$$*L = \frac{-j \cdot 1000 \cdot 0,002}{2,3,14 \cdot 3000 \cdot -j 0,0079}$$

$$= 13 \text{ mH}$$

$$f = 3000 \text{ Hz}$$

$$*C = \frac{j \cdot 0,00795}{j \cdot 2,3,14 \cdot 3000 \cdot 1000 \cdot 0,002}$$

$$= 0,21 \mu\text{F}$$

$$*Q = 2,3,14 \cdot 3000 \cdot 0,21 \cdot 10^{-6} \cdot 1000$$

$$= 3,956$$

$$4. f = 4000 \text{ Hz}$$

$$*L = \frac{-j \cdot 1000 \cdot 0,002}{2,3,14 \cdot 4000 \cdot -j 0,0079}$$

$$= 10 \text{ mH}$$

$$*C = \frac{j \cdot 0,00795}{j \cdot 2,3,14 \cdot 4000 \cdot 1000 \cdot 0,002}$$

$$= 0,157 \mu\text{F}$$

$$*Q = 2,3,14 \cdot 4000 \cdot 0,157 \cdot 10^{-6} \cdot 1000$$

$$= 3,943$$

$$5. f = 5000 \text{ Hz}$$

$$*L = \frac{-j \cdot 1000 \cdot 0,002}{2,3,14 \cdot 5000 \cdot -j 0,0079}$$

$$= 8 \text{ mH}$$

$$*C = \frac{j \cdot 0,00795}{j \cdot 2,3,14 \cdot 5000 \cdot 1000 \cdot 0,002}$$

$$= 0,126 \mu\text{F}$$

$$*Q = 2,3,14 \cdot 5000 \cdot 0,126 \cdot 10^{-6} \cdot 1000$$

$$= 3,956$$