# COMPORTEMENT FRÉQUENTIEL

## CIRCUITS RÉSONANTS - CONDITIONS DE RÉSONANCE – CIRCUITS ÉQUIVALENTS

LEÇON 21

**Électrotechnique I**

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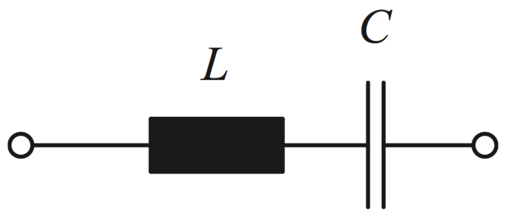
Laboratoire d'Actionneurs Intégrés

# INTRODUCTION

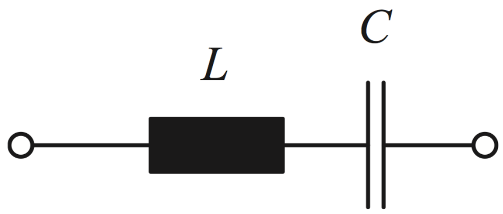
## Généralités

- Circuits résonants idéaux
  - Circuit *LC* série – Circuit *LC* parallèle
  - Comportement en fréquence
  - Condition de résonance
- Dipôles équivalents
- Conclusion

# Circuits résonants – LC série idéal - Conditions de résonance

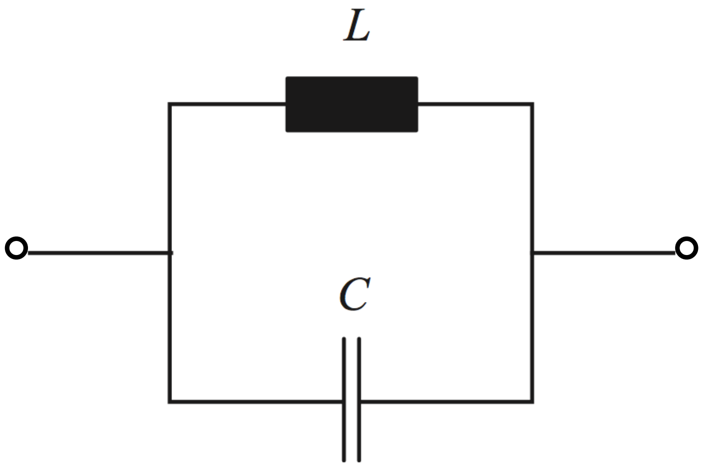


## Circuits résonants – LC série idéal - Conditions de résonance

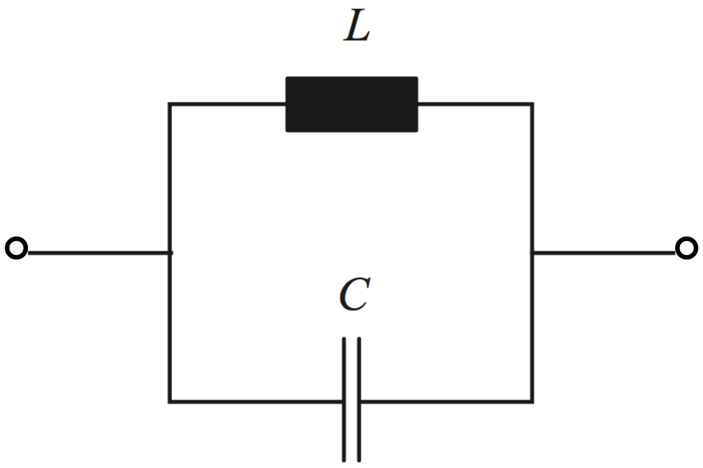



$$\underline{Z}_{eq} = \mathrm{j}\omega L - \mathrm{j}\frac{1}{\omega C} = \mathrm{j}\frac{\omega^2 LC - 1}{\omega C}$$

# Circuits résonants – LC parallèle idéal - Conditions de résonance

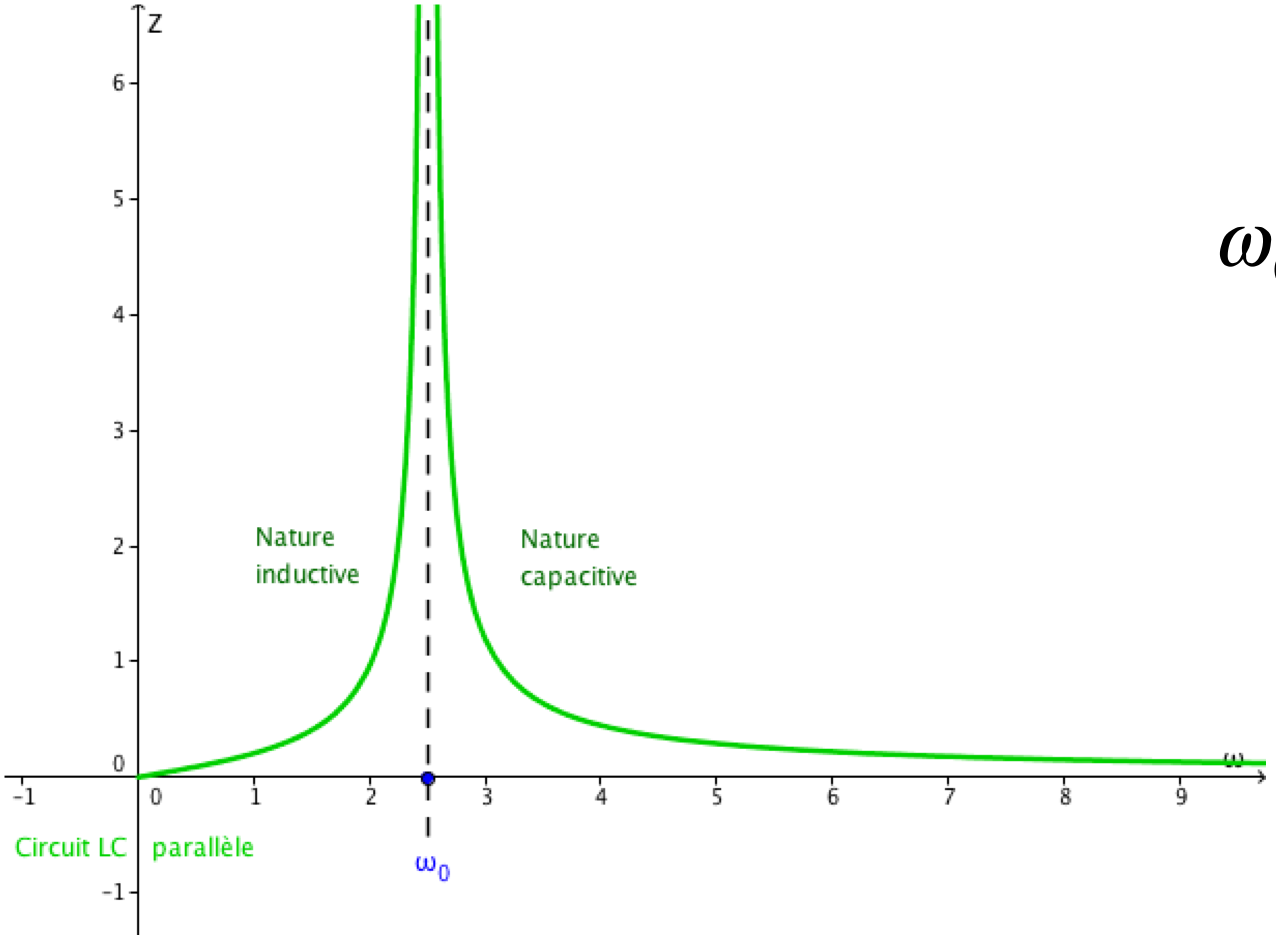


# Circuits résonants – LC parallèle idéal - Conditions de résonance



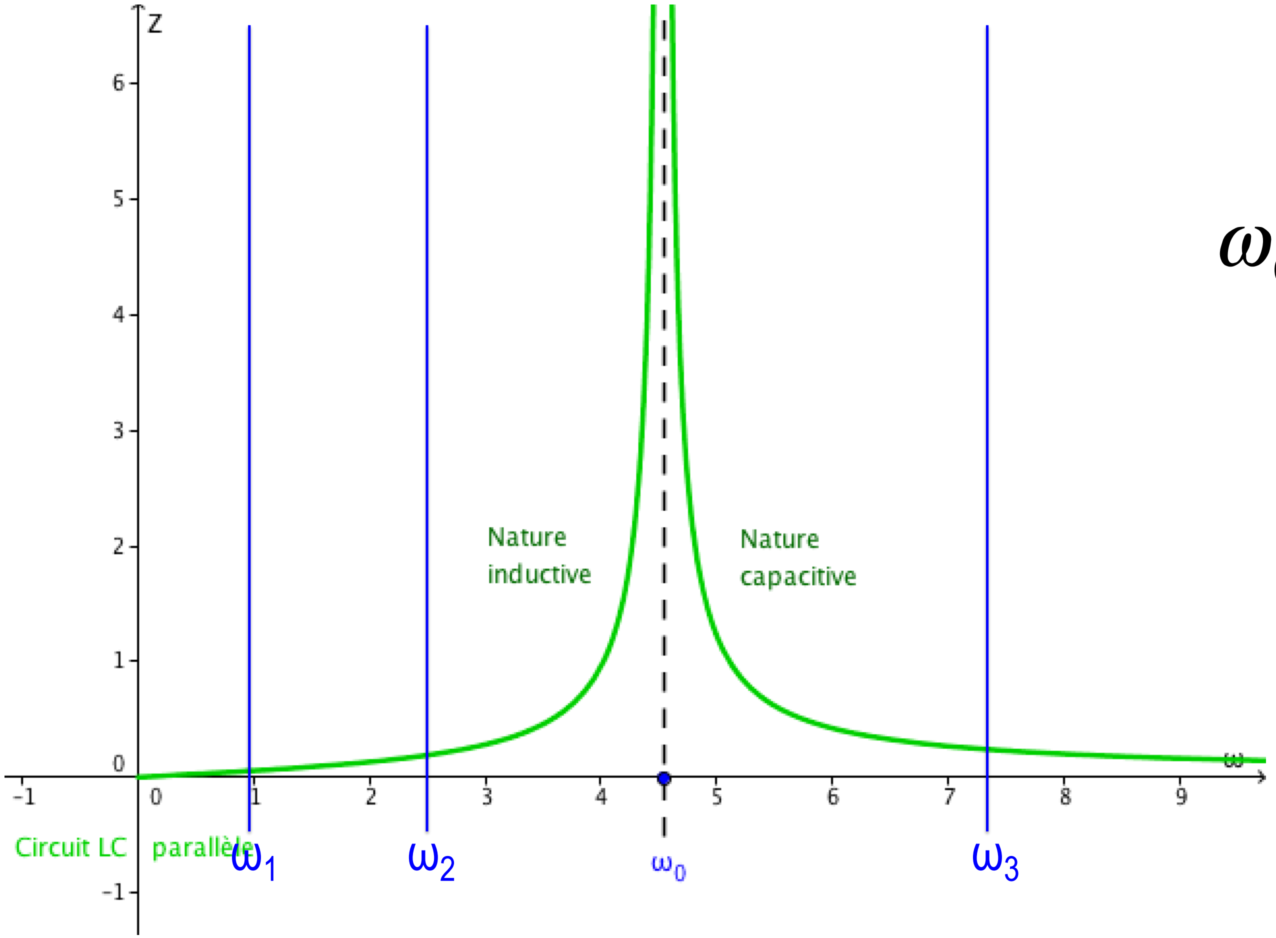

$$\underline{Z}_{eq} = \frac{1}{\frac{1}{j\omega L} + j\omega C} = \frac{j\omega L}{1 - \omega^2 LC} = j\left(\frac{\omega L}{1 - \omega^2 LC}\right)$$

## Circuits résonants - Conditions de résonance – Modification de $\omega_0$



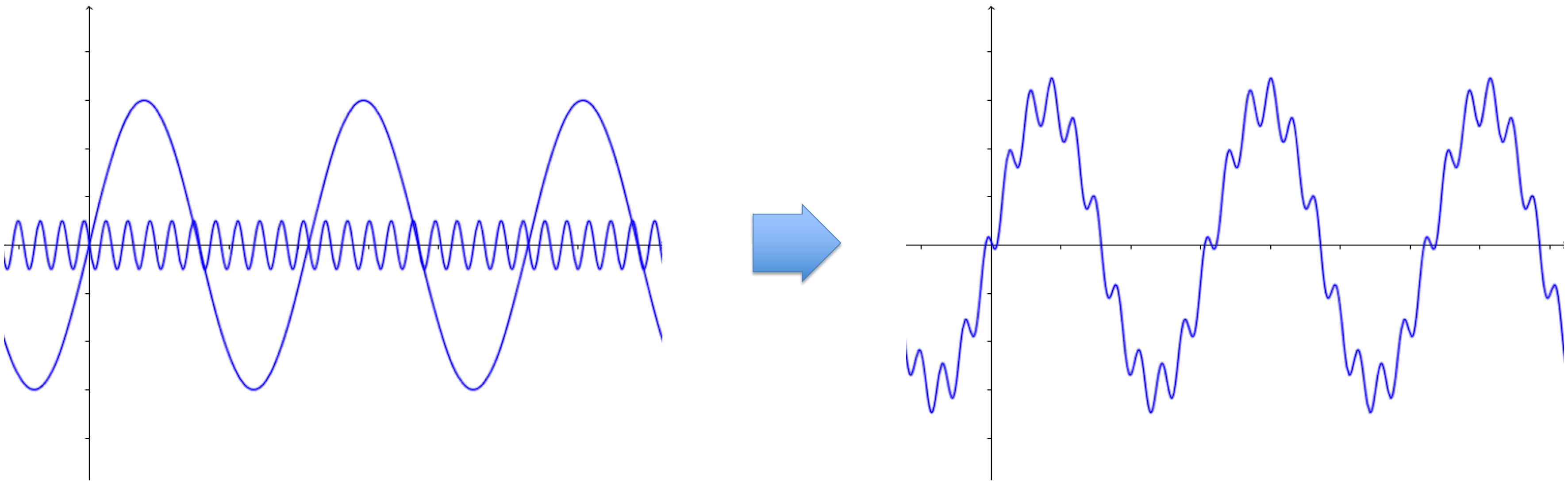

$$\omega_{0_1} = \frac{1}{\sqrt{L_1 C_1}}$$

# Circuits résonants - Conditions de résonance – Modification de $\omega_0$




$$\omega_{0_2} = \frac{1}{\sqrt{L_2 C_2}}$$

## Circuits résonants – Exemples



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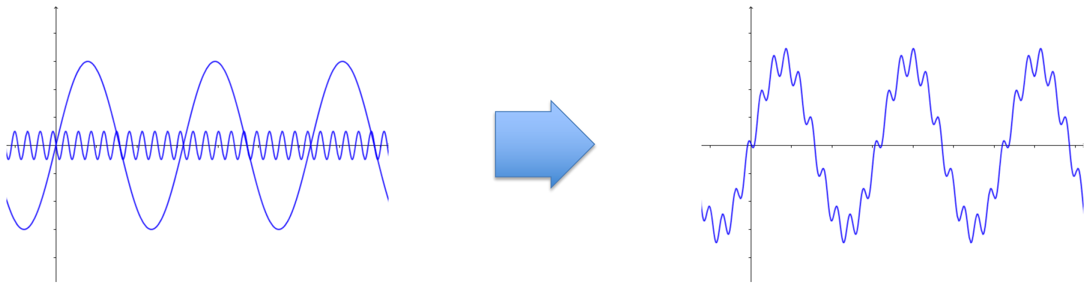
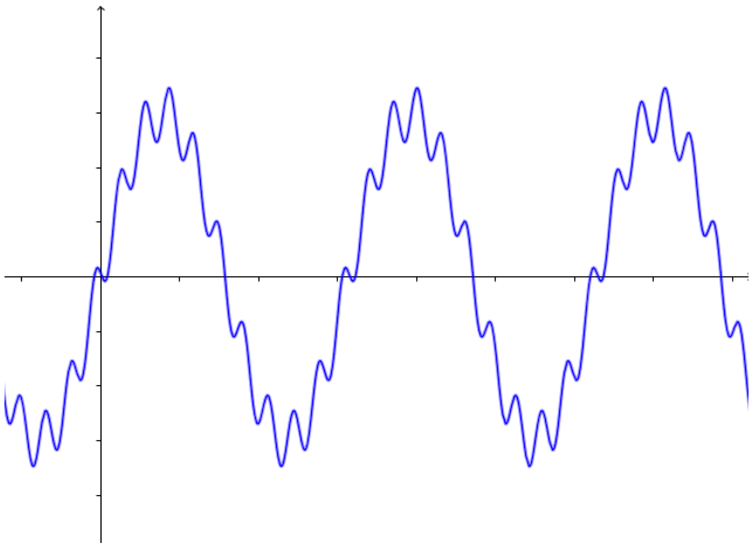
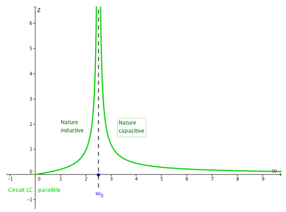
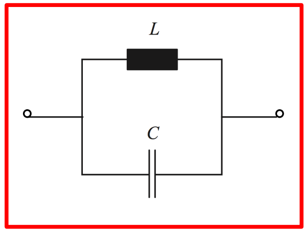




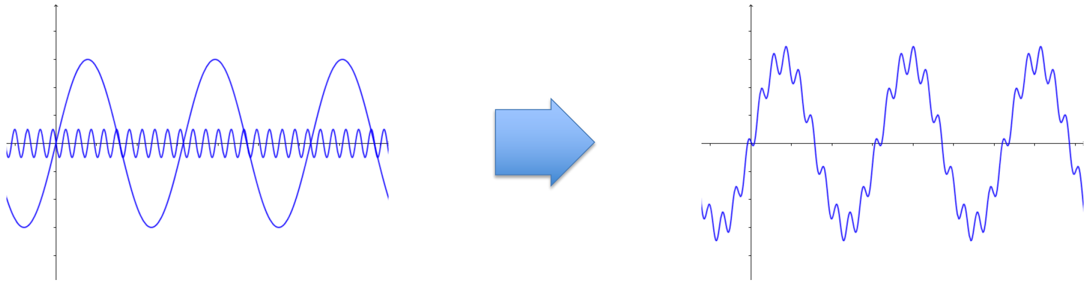


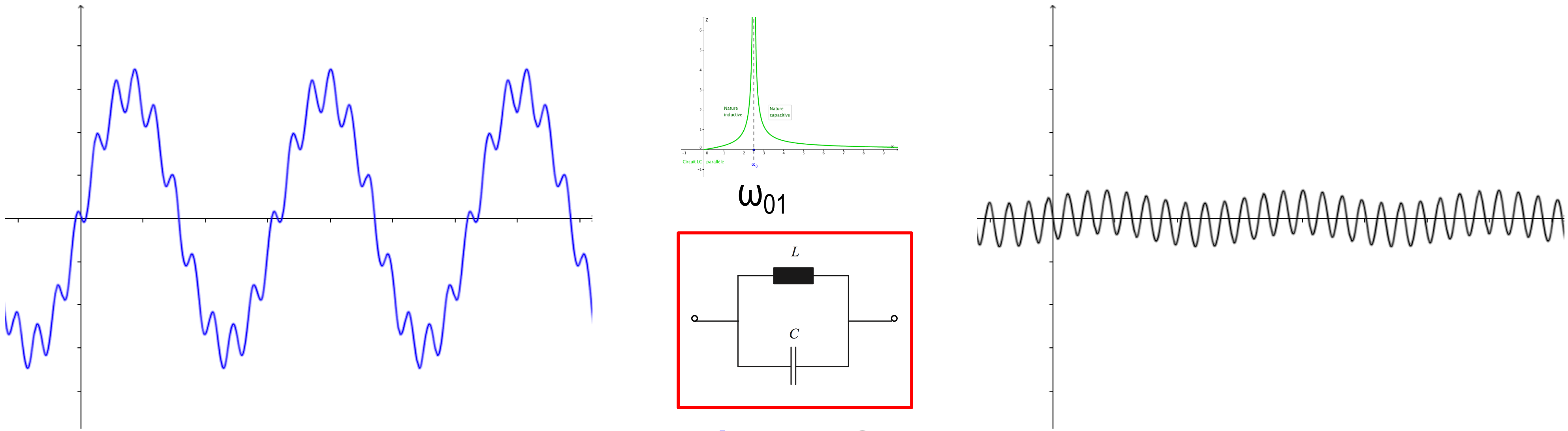
$\omega_{01}$




**Entrée** - **Sortie**

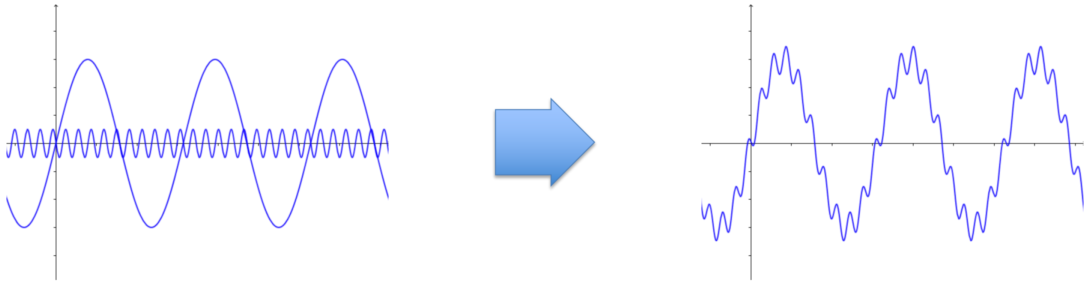
## Circuits résonants – Exemples

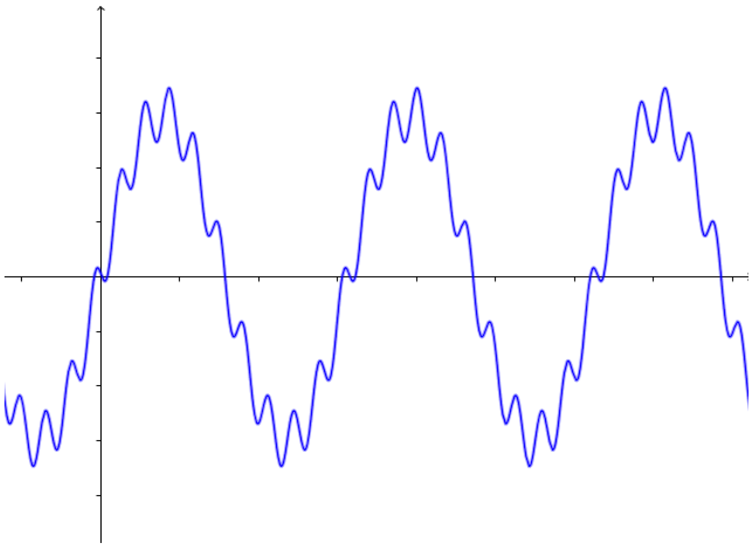


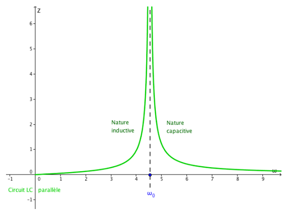



Entrée - Sortie

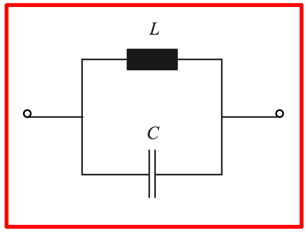
## Circuits résonants – Exemples





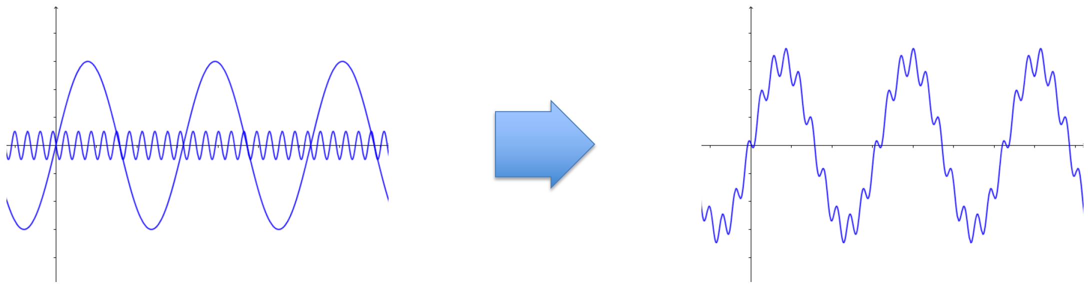


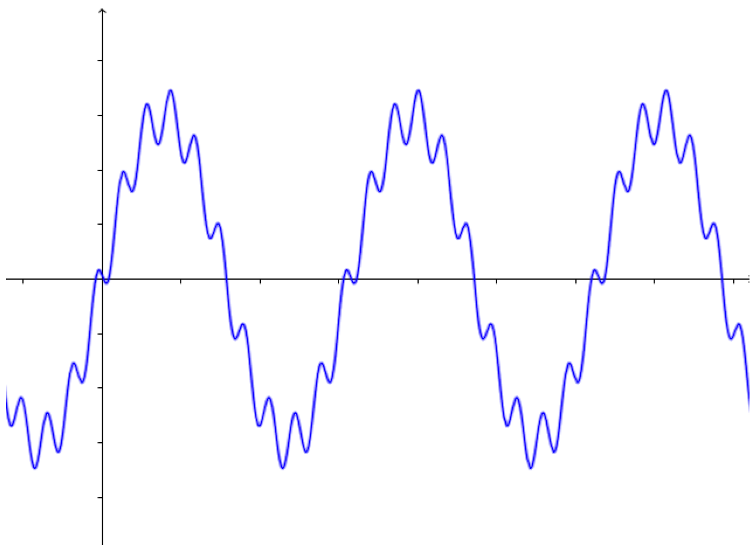

$\omega_{02}$

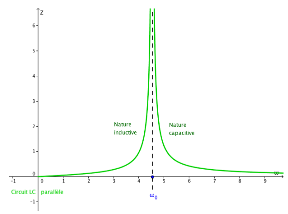



**Entrée - Sortie**

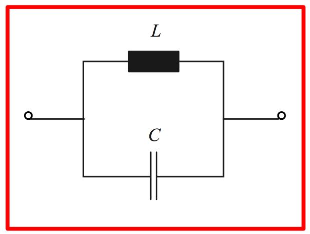
## Circuits résonants – Exemples

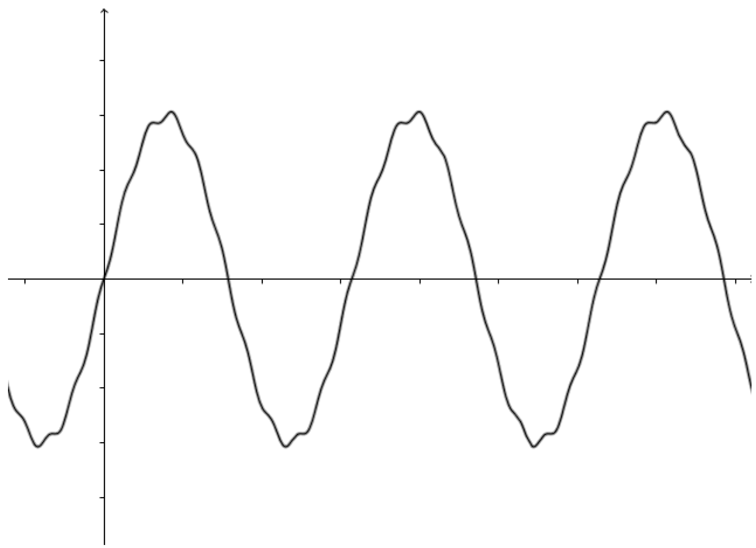






$\omega_{02}$



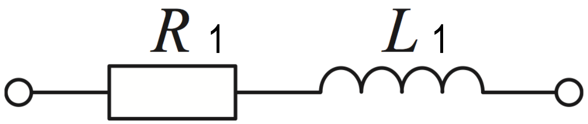
**Entrée** - **Sortie**

## Exemples d'application

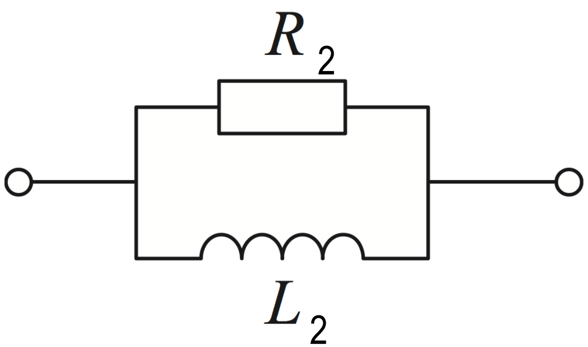
Exemple :
ADSL (Asymmetric Digital Subscriber Line)


Exemple :
CPL (Courants Porteurs en Ligne)

## Dipôles équivalents




$$\underline{Z} = R_1 + j\omega L_1$$




$$\underline{Z} = \frac{R_2\omega^2 L_2^2 + j\omega L_2 R_2^2}{R_2^2 + \omega^2 L_2^2}$$

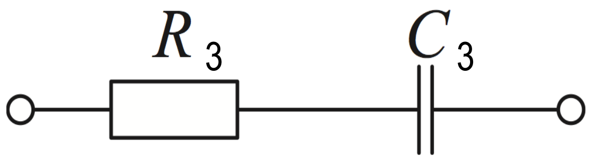
Ces deux circuits sont équivalents si :

$R_1$ =

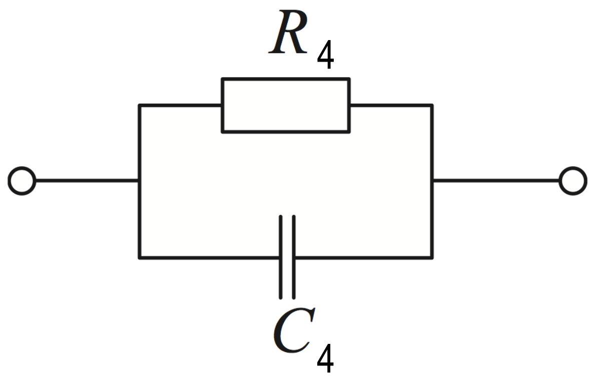
et :

$L_1$ =

## Dipôles équivalents




$$\underline{Z} = R_3 + \frac{1}{j\omega C_3} = R_3 - j\frac{1}{\omega C_3}$$




$$\underline{Z} = \frac{R_4 - j\omega C_4 R_4^2}{1+\omega^2 R_4^2 C_4^2}$$

Ces deux circuits sont équivalents si :

$R_3$ =

et :

$C_3$ =

# CONCLUSIONS

- Circuits résonants
  - Caractéristiques
  - Condition de résonance
- Effet de la modification des paramètre *L* et *C*
  - Applications
- Dipôles équivalents
  - Dépendance de la fréquence