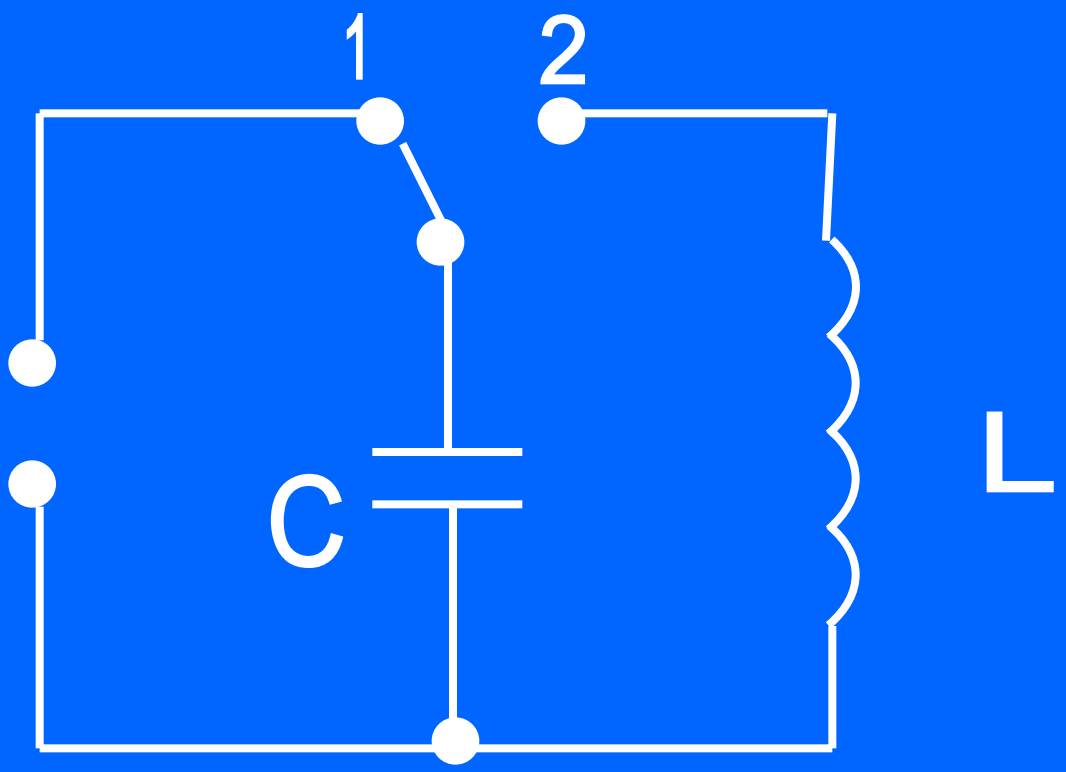
"Электромагнитные колебания"

Свободные электромагнитные колебания

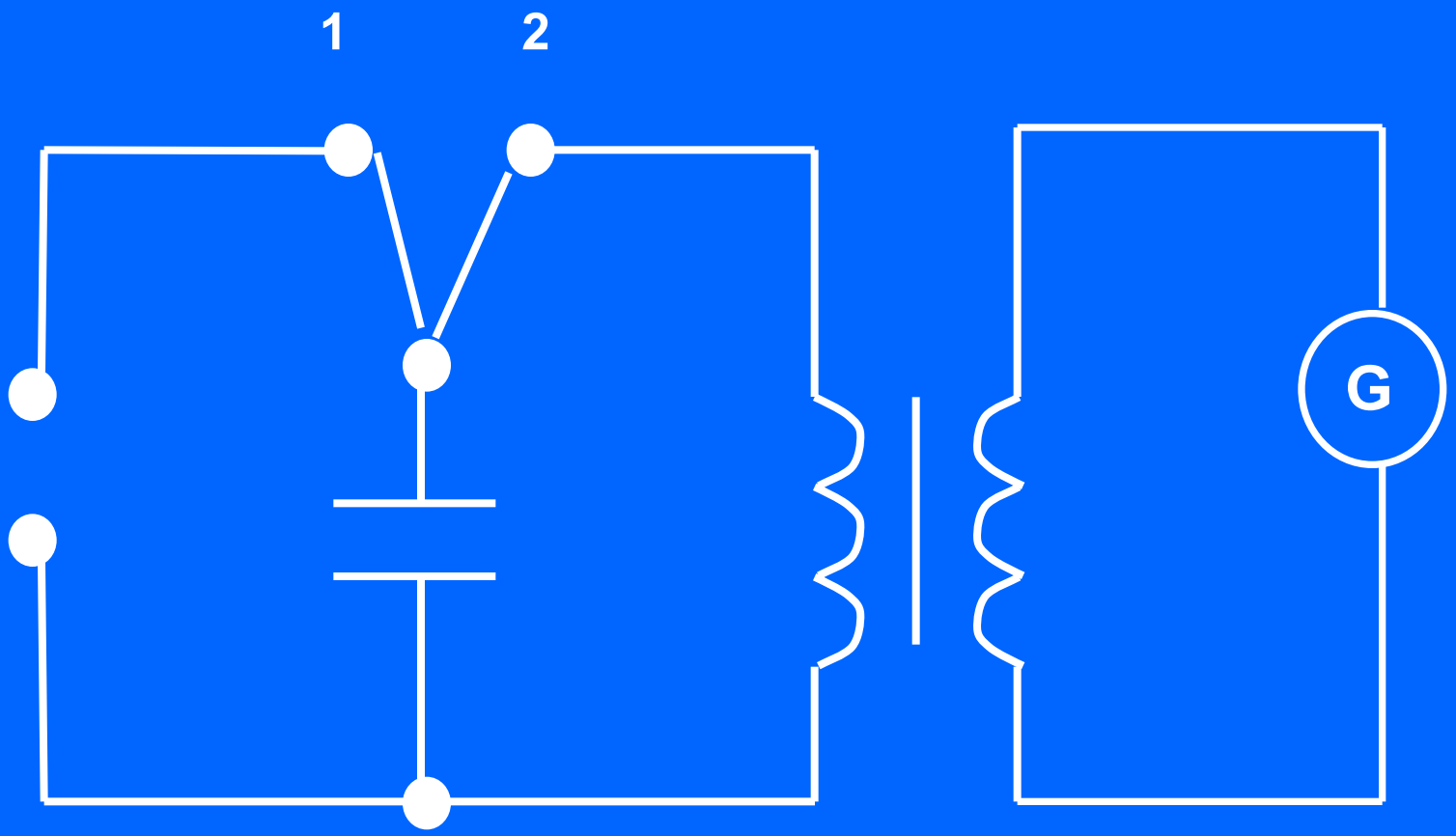
в колебательном контуре.

Идеальный колебательный контур

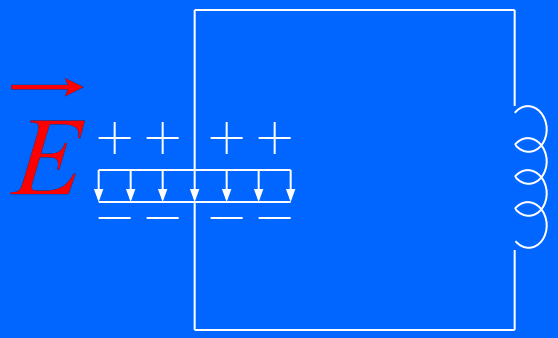
Колебательный контур



Электромагнитные колебания в контуре



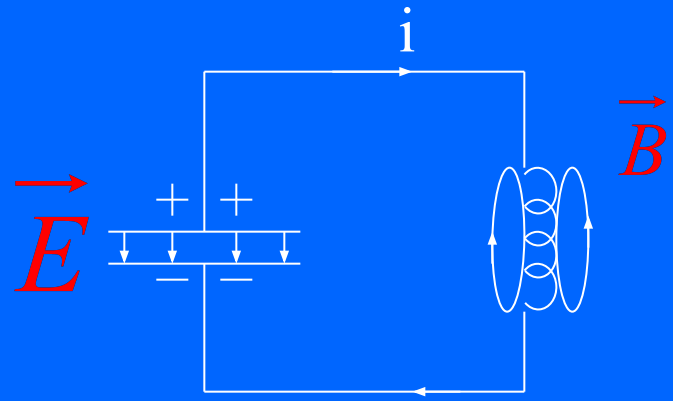
ПРЕВРАЩЕНИЕ ЭНЕРГИИ В КОЛЕБАТЕЛЬНОМ КОНТУРЕ.



t=0

$$q = q_m; \quad u_c = U_m; \quad W_{эл} = \frac{q_m^2}{2C};$$

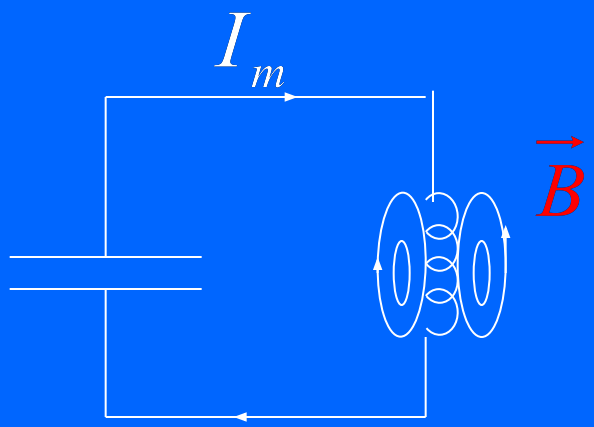
$$i = 0; \qquad W_м = 0.$$



$0 < t < \frac{T}{4}$

$$q \downarrow; \quad u_c \downarrow; \quad W_{эл} = \frac{q^2}{2C};$$

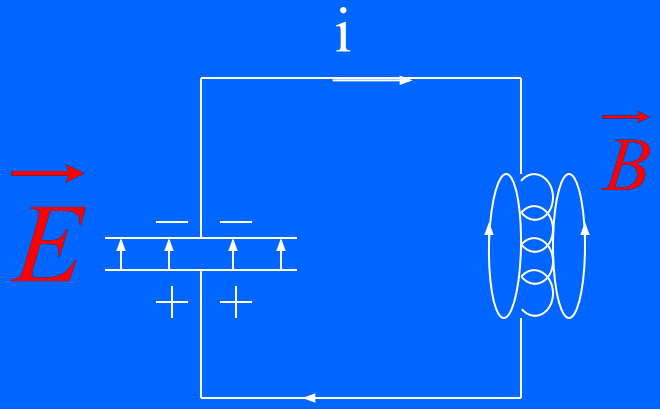
$$i \uparrow; \quad W_м = \frac{Li^2}{2}; \quad W_{эл} \to W_м.$$



$t = \frac{T}{4}$

$$q = 0; \quad u_c = 0; \quad W_{эл} = 0;$$

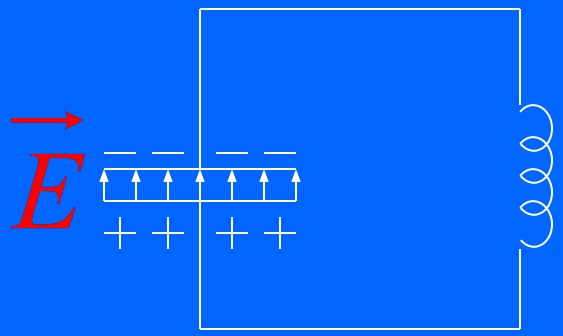
$$i = I_m; \qquad W_м = \frac{LI_m^2}{2}.$$



$$\frac{T}{4}<t<\frac{T}{2}$$

$$q\uparrow;\ u_c\uparrow;\qquad W_{эл}=\frac{q_m^2}{2C};$$

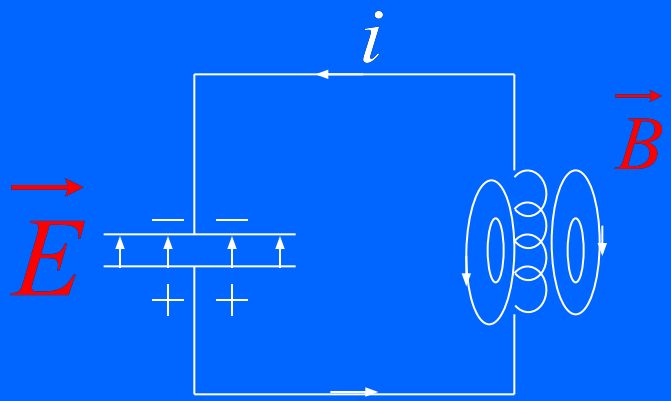
$$i\downarrow;\quad W_м=\frac{Li^2}{2};\quad W_м\to W_{эл}$$



$$t=\frac{T}{2}$$

$$q=q_m;\quad u_c=U_m;\quad W_{эл}=\frac{q_m^2}{2C};$$

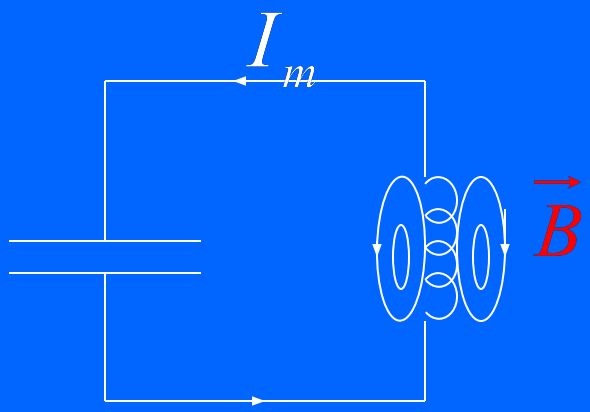
$$i=0;\qquad W_м=0.$$



$$\frac{T}{2}<t<\frac{3T}{4}$$

$$q\downarrow;\qquad u_c\downarrow;\qquad W_{эл}=\frac{q^2}{2C};$$

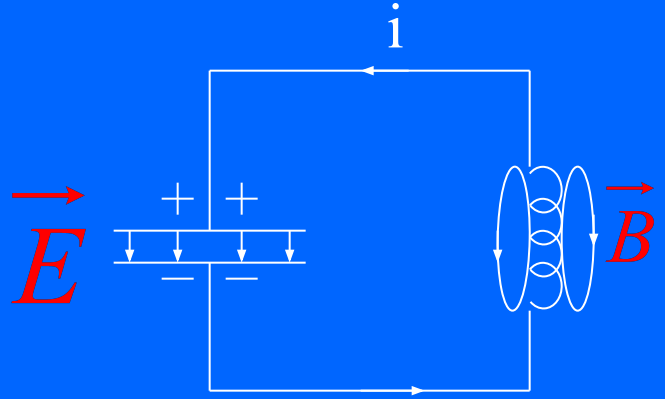
$$i\uparrow;\quad W_м=\frac{LI_m^2}{2};\quad W_{эл}\to W_м.$$



$t=\frac{3T}{4}$

$q=0;\quad u_c=0;\quad W_{эл}=0;$

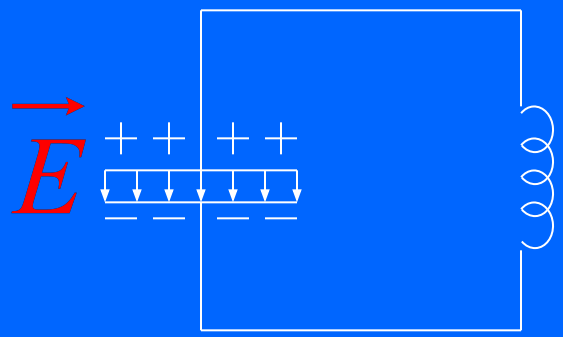
$i=I_m;\qquad W_м=\frac{LI_m^2}{2}.$



$\frac{3T}{4}<t<T$

$q\uparrow;\ u_c\uparrow;\qquad W_{эл}=\frac{q^2}{2C};$

$i\downarrow;\quad W_м=\frac{Li^2}{2};\quad W_{эл}\rightarrow W_м$

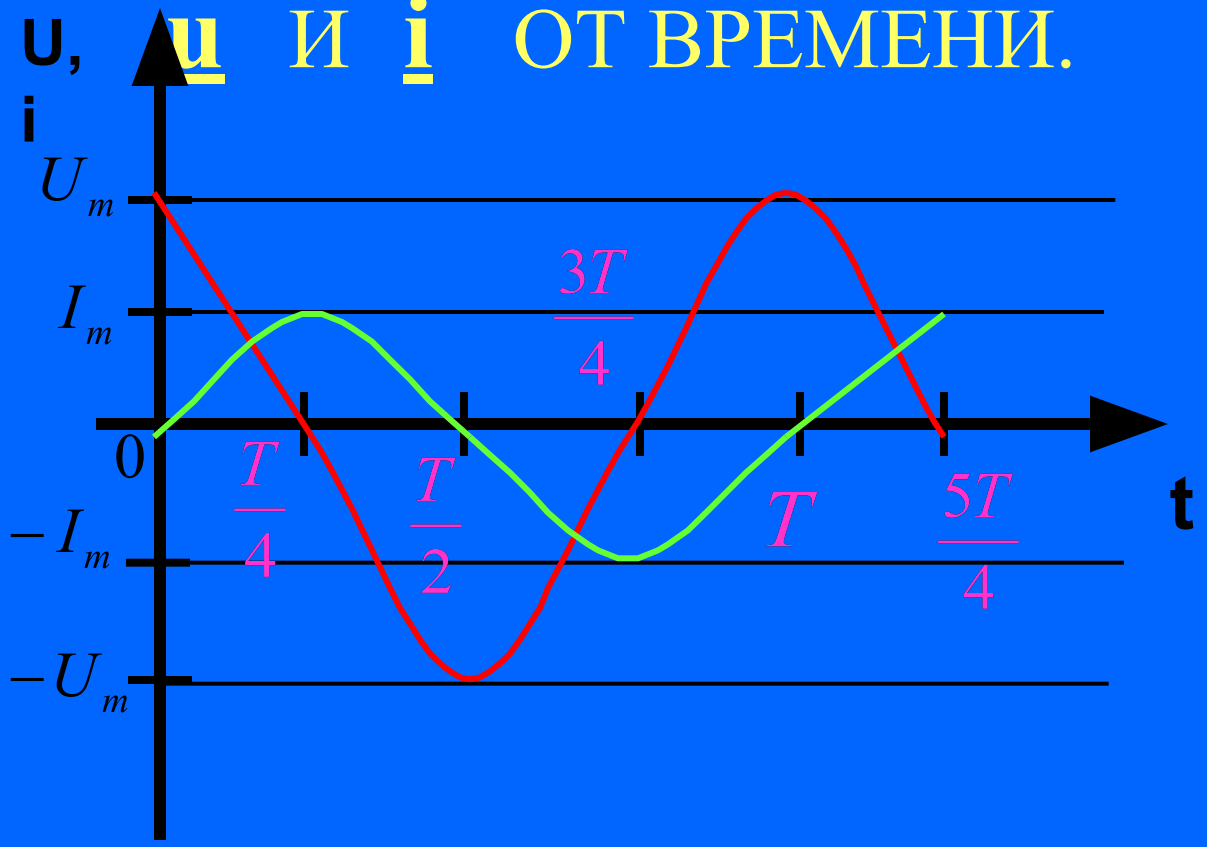


t=T

$q=q_m;\quad u_c=U_m;\quad W_{эл}=\frac{q_m^2}{2C};$

$i=0;\qquad W_м=0.$

ЗАВИСИМОСТЬ МГНОВЕННЫХ ЗНАЧЕНИЙ **u** И **i** ОТ ВРЕМЕНИ.

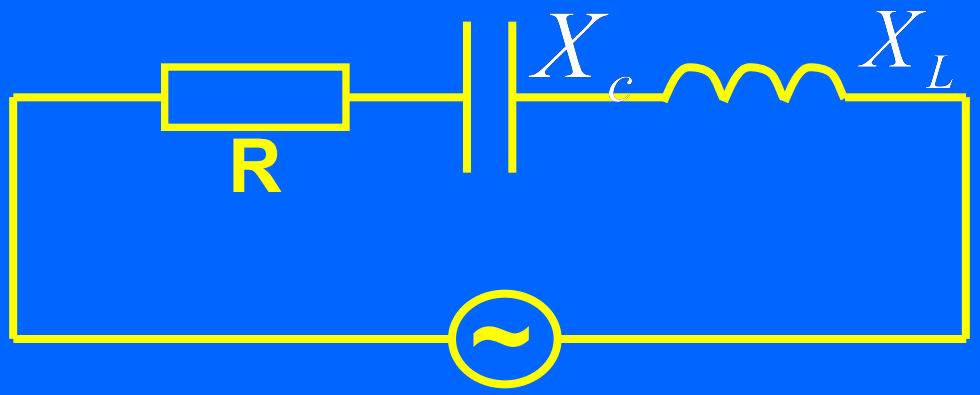


$$u = U_m \cos \omega t;$$

$$i = I_m \cos\left(\omega t - \frac{\pi}{2}\right).$$

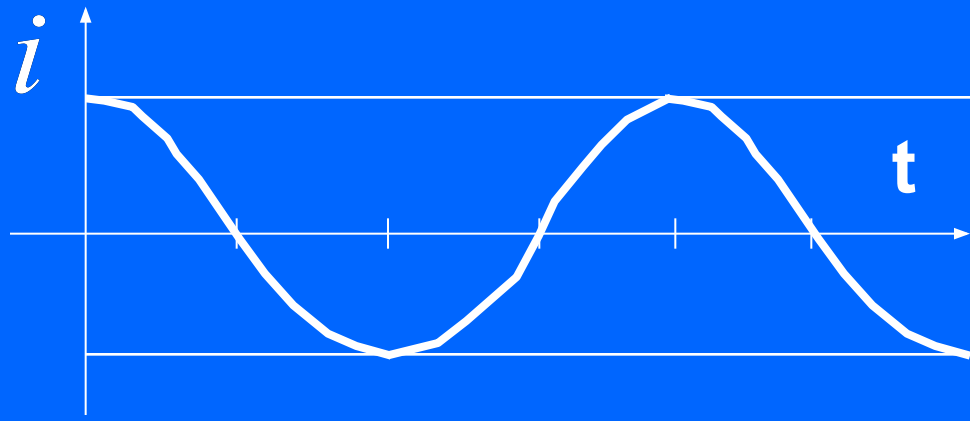
Вынужденные электромагнитные колебания

в колебательном контуре.



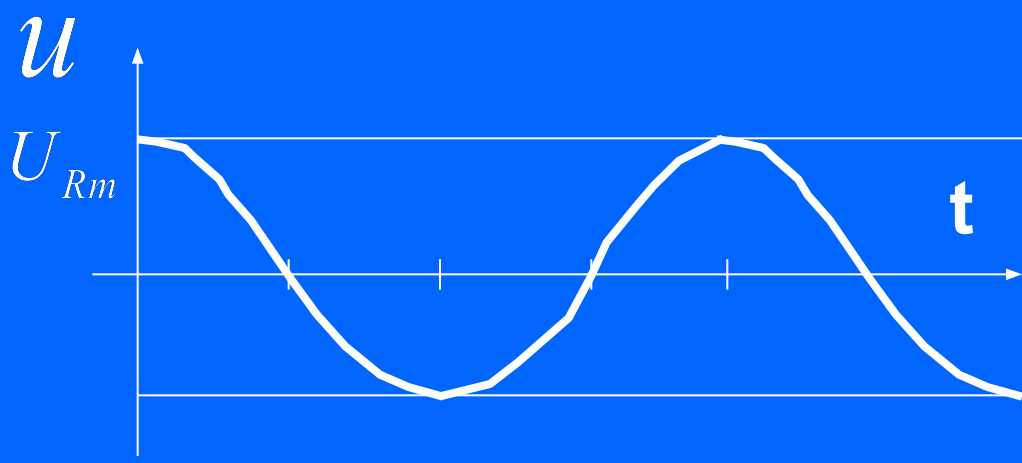
$$i = I_m \cos \omega t;$$

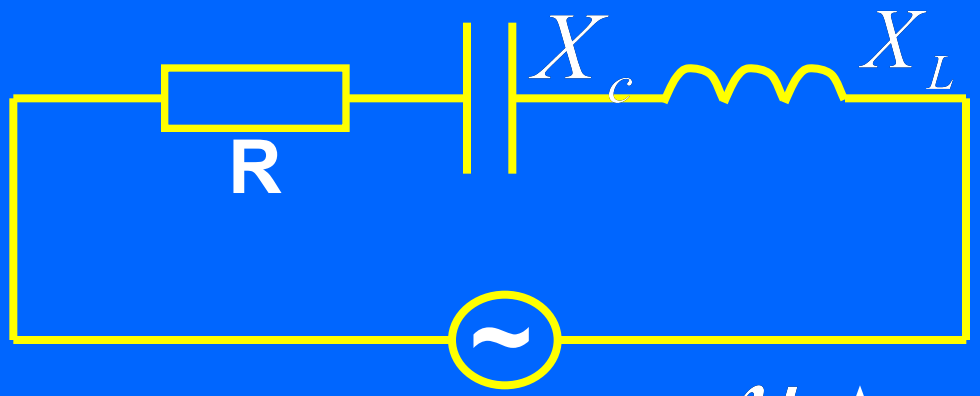
$$U_m = ZI_m;$$



$$u_R = U_{Rm} \cos \omega t;$$

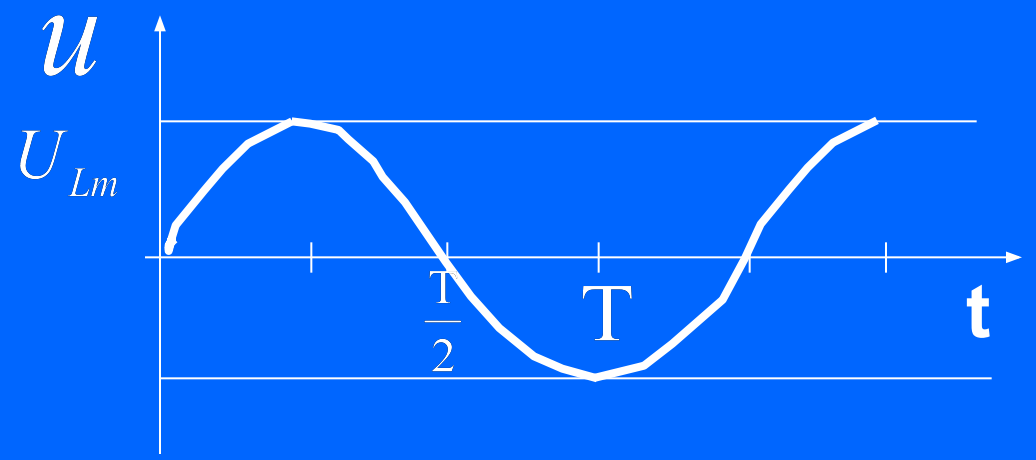
$$U_{Rm} = I_m R.$$





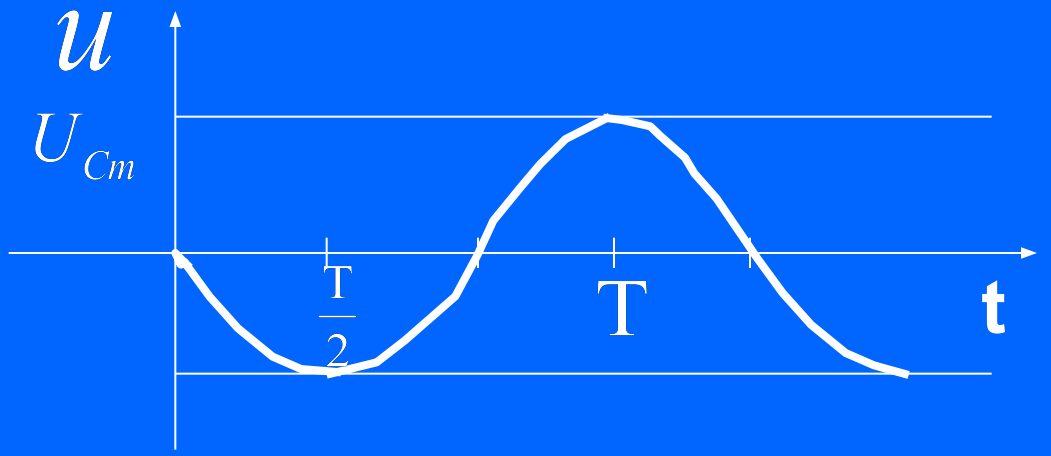
$$u_L = U_{Lm}\cos\left(\omega t + \frac{\pi}{2}\right);$$

$$U_{Lm} = I_m X_L;$$



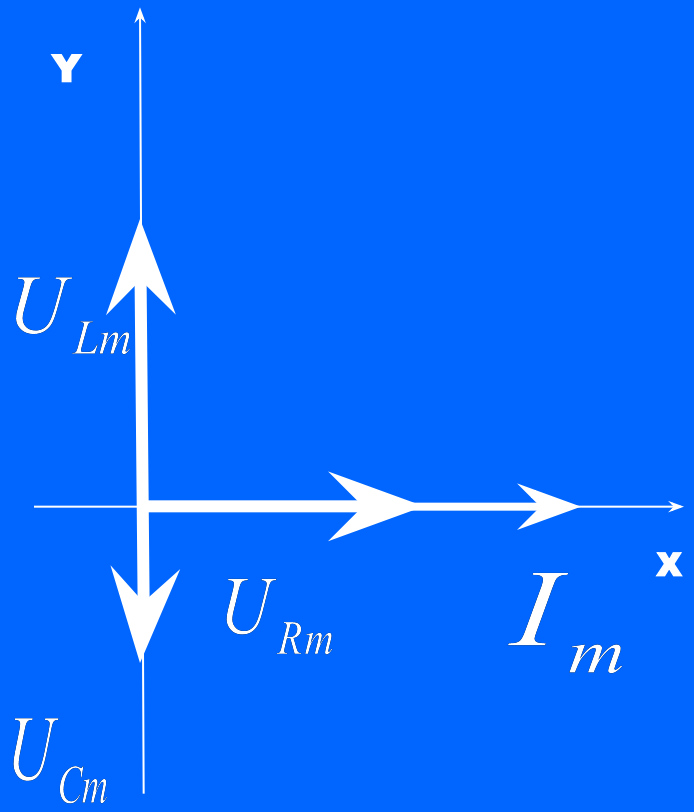
$$u_C = U_{Cm}\cos\left(\omega t - \frac{\pi}{2}\right);$$

$$U_{Cm} = I_m X_C.$$

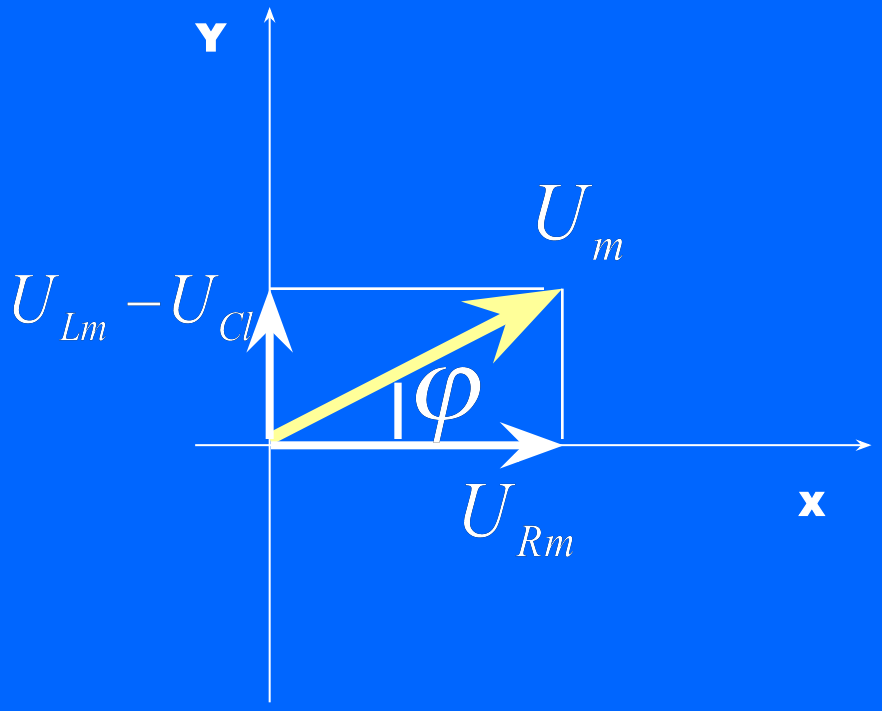


Векторная диаграмма колебательного контура

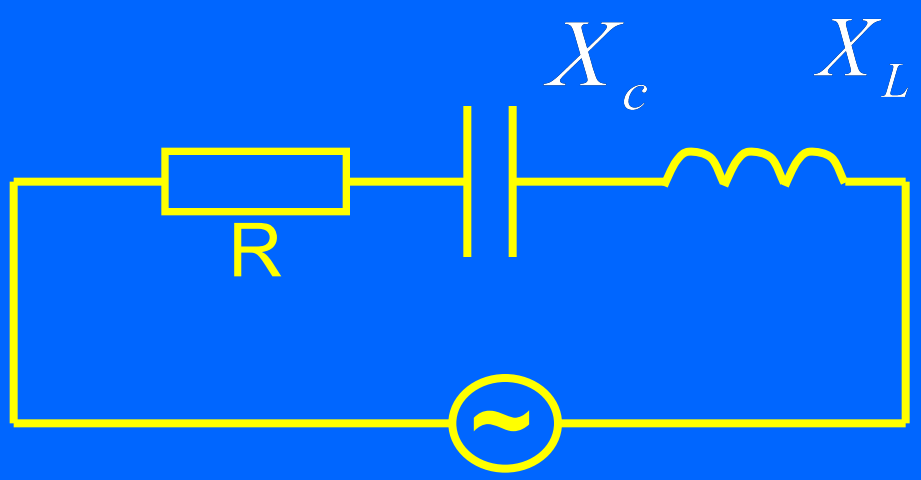
$$U = U_R + U_C + U_L$$

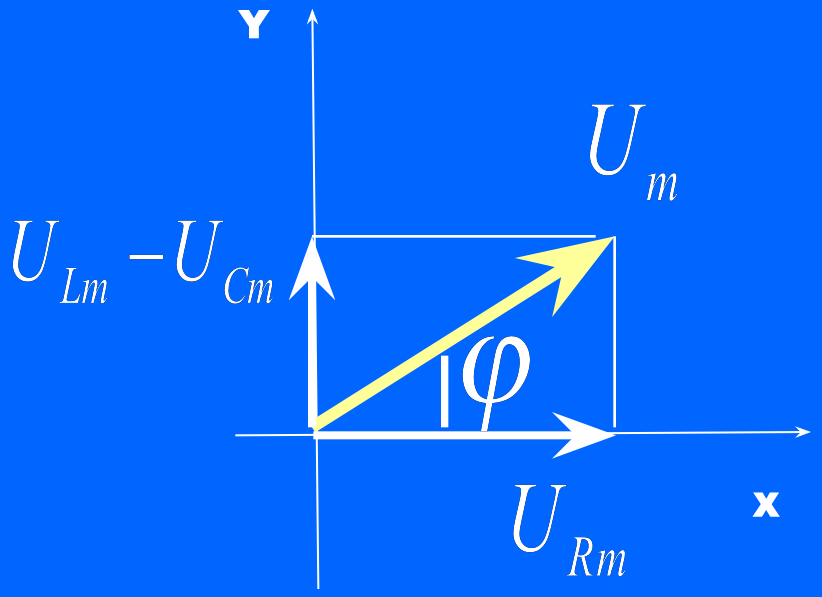


Напряжение на элементах



Напряжение приложенное к контуру

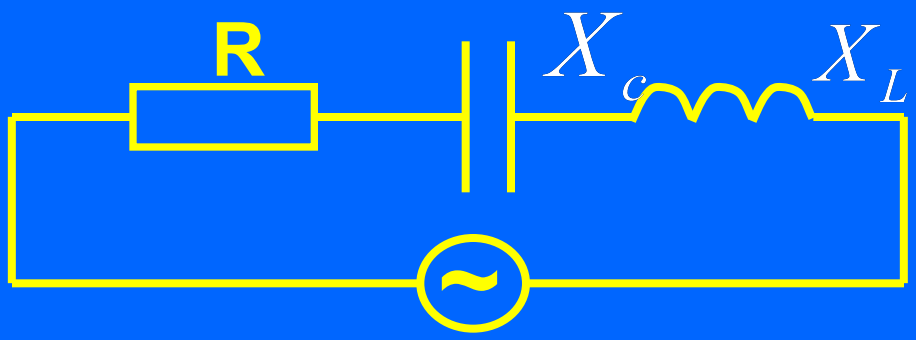


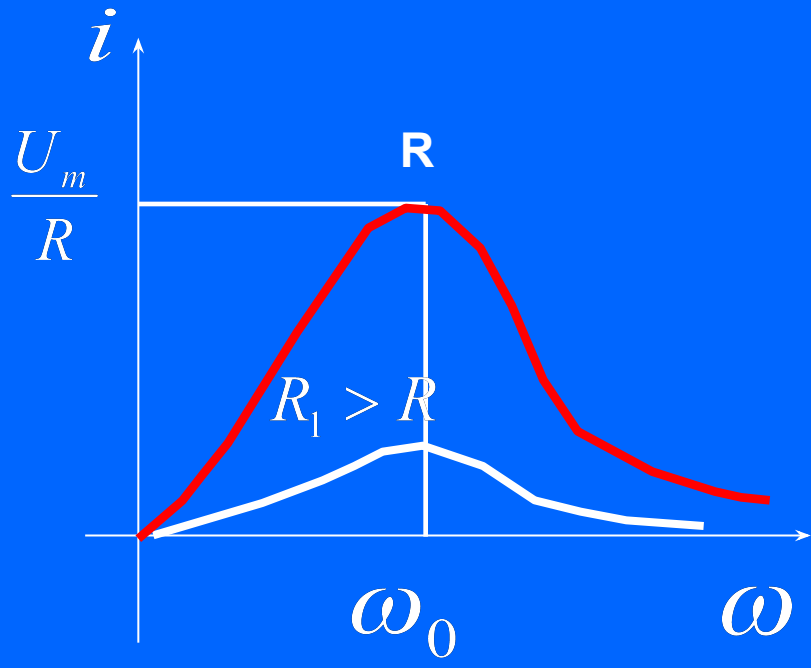


$$Z = \sqrt{R^2 + \left(wL - \frac{1}{wC} \right)^2};$$

$$\varphi = arctg \frac{wL - \frac{1}{wC}}{R}.$$

Резонанс в колебательном контуре





$$\omega = \omega_0;$$

$$\omega_0 = \frac{1}{\sqrt{LC}}; \quad \omega^2 = \frac{1}{LC};$$

$$\omega L = \frac{1}{\omega C} \Rightarrow X_L = X_C$$