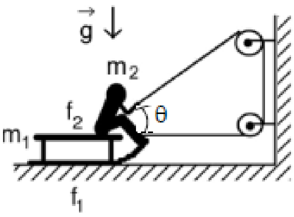


35. m_1 kütleli kızağın üzerindeki m_2 kütleli çocuk iki makaradan geçen ipi çekerek kızakla birlikte kaymadan karın üzerinde ilerlemek istiyor. Karla kızak arasındaki sürtünme katsayısı f_1 olarak veriliyor. Çocukla kızak arasındaki sürtünme katsayısı f_2 ne kadar olmalıdır ki çocukla kızak birlikte hareket etsinler? $\left(\dfrac{f_1(m_1+m_2)\cos\theta}{m_2(1+\cos\theta)-f_1 m_1\sin\theta}\right)$

$$T\cos\theta - F_{s2} = 0 \Rightarrow m_2 g - N_2 - T\sin\theta = 0$$

$$m_1 g + N_2 - N_1 = 0 \Rightarrow T + F_{s2} - F_{s1} = 0$$

$$N_2 = m_2 g - T\sin\theta \Rightarrow T\cos\theta = f_2 N_2 = f_2(m_2 g - T\sin\theta) \Rightarrow T(\cos\theta + f_2\sin\theta) = f_2 m_2 g \Rightarrow T = \frac{f_2 m_2 g}{\cos\theta + f_2\sin\theta}$$

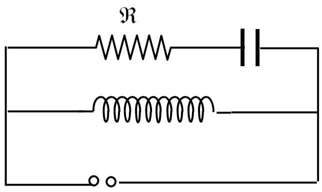
$$N_2 = m_2 g - \frac{f_2 m_2 g\sin\theta}{\cos\theta + f_2\sin\theta} \Rightarrow N_1 = m_1 g + m_2 g - \frac{f_2 m_2 g\sin\theta}{\cos\theta + f_2\sin\theta}$$

$$\frac{f_2 m_2 g}{\cos\theta + f_2\sin\theta} + f_2\left(m_2 g - \frac{f_2 m_2 g\sin\theta}{\cos\theta + f_2\sin\theta}\right) - f_1\left(m_1 g + m_2 g - \frac{f_2 m_2 g\sin\theta}{\cos\theta + f_2\sin\theta}\right) = 0$$

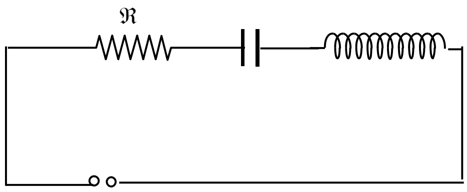
$$f_2 m_2 g + f_2(m_2 g\cos\theta + f_2 m_2 g\sin\theta - f_2 m_2 g\sin\theta) - f_1(m_1 g\cos\theta + m_2 g\cos\theta + m_1 g f_2\sin\theta + m_2 g f_2\sin\theta - f_2 m_2 g\sin\theta) = 0$$

$$f_2 m_2 g + f_2 m_2 g\cos\theta - f_1(m_1 g\cos\theta + m_2 g\cos\theta) - f_1 f_2 m_1 g\sin\theta = 0$$

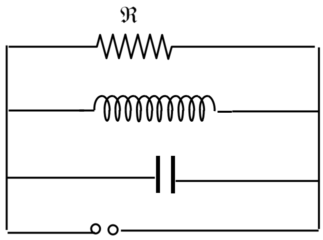
$$f_2\left[m_2(1+\cos\theta) - f_1 m_1\sin\theta\right] = f_1(m_1+m_2)\cos\theta \Rightarrow f_2 = \frac{f_1(m_1+m_2)\cos\theta}{m_2(1+\cos\theta) - f_1 m_1\sin\theta}$$



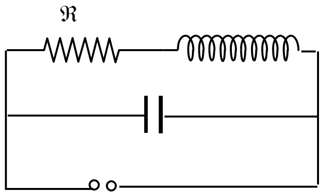
$U = U_0\sin\omega t$



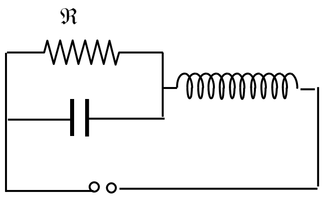
$U = U_0\sin\omega t$



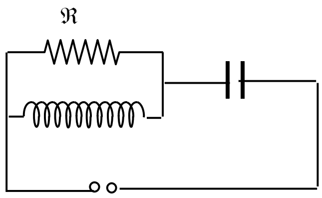
$U = U_0\sin\omega t$



$U = U_0\sin\omega t$



$U = U_0\sin\omega t$

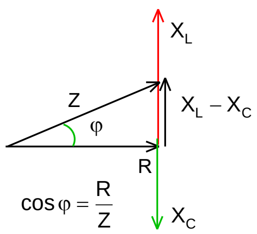


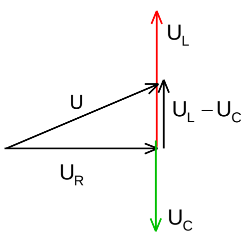
$U = U_0\sin\omega t$

$$I = \frac{U_0\sin\omega t}{R}$$

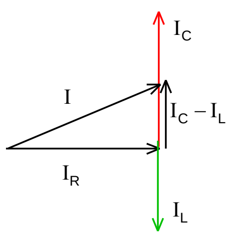
$$U_0\sin\omega t - L\frac{dI}{dt} = 0 \Rightarrow dI = \frac{U_0\sin\omega t dt}{L} \Rightarrow I = \int\frac{U_0\sin\omega t dt}{L} = -\frac{U_0\cos\omega t}{\omega L} = \frac{U_0}{X_L}\sin\left(\omega t - \frac{\pi}{2}\right)$$

$$U_0\sin\omega t = \frac{q}{C} \Rightarrow q = U_0 C\sin\omega t \Rightarrow I = \frac{dq}{dt} = U_0\omega C\cos\omega t = \frac{U_0\cos\omega t}{\frac{1}{\omega C}} = \frac{U_0}{X_C}\sin\left(\omega t + \frac{\pi}{2}\right)$$



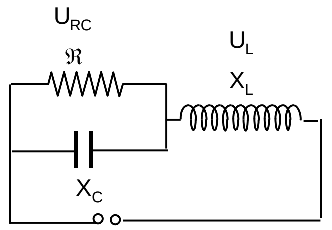


$$U = \sqrt{U_R^2 + (U_L - U_C)^2}$$

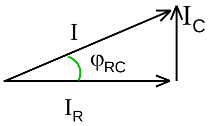


$$I = \sqrt{I_R^2 + (I_L - I_C)^2} \Rightarrow \frac{U}{Z} = \sqrt{\left(\frac{U}{R}\right)^2 + \left(\frac{U}{X_L} - \frac{U}{X_C}\right)^2}$$

$$\frac{1}{Z} = \sqrt{\frac{1}{R^2} + \left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2}$$



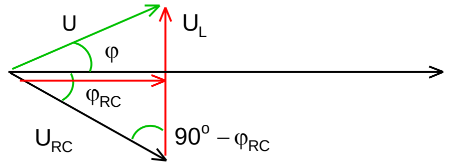
$U = U_0 \sin\omega t$



$$I = \sqrt{I_R^2 + I_C^2} \Rightarrow \frac{U_{RC}}{Z_{RC}} = \sqrt{\left(\frac{U_{RC}}{R}\right)^2 + \left(\frac{U_{RC}}{X_C}\right)^2}$$

$$\frac{1}{Z_{RC}} = \sqrt{\frac{1}{R^2} + \frac{1}{X_C^2}} = \sqrt{\frac{R^2 + X_C^2}{R^2 X_C^2}} = \frac{\sqrt{R^2 + X_C^2}}{RX_C}$$

$$Z_{RC} = \frac{RX_C}{\sqrt{R^2 + X_C^2}} \Rightarrow \tan\varphi_{RC} = \frac{I_C}{I_R} = \frac{\frac{U_{RC}}{X_C}}{\frac{U_{RC}}{R}} = \frac{R}{X_C}$$



$$\sin\varphi_{RC} = \frac{\tan\varphi_{RC}}{\sqrt{1 + \tan^2\varphi_{RC}}} = \frac{\frac{R}{X_C}}{\sqrt{1 + \left(\frac{R}{X_C}\right)^2}} = \frac{R}{\sqrt{R^2 + X_C^2}}$$

$$\cos\varphi_{RC} = \frac{1}{\sqrt{1 + \tan^2\varphi_{RC}}} = \frac{1}{\sqrt{1 + \left(\frac{R}{X_C}\right)^2}} = \frac{X_C}{\sqrt{R^2 + X_C^2}}$$

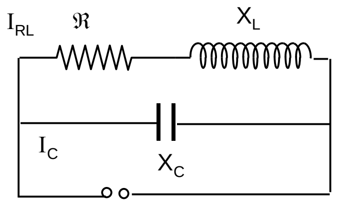
$$U = \sqrt{U_{RC}^2 + U_L^2 - 2U_{RC}U_L\cos\left(90^o - \varphi_{RC}\right)}$$

$$IZ = \sqrt{I^2 Z_{RC}^2 + I^2 X_L^2 - 2IZ_{RC}IX_L\sin\varphi_{RC}}$$

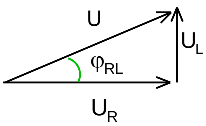
$$Z = \sqrt{Z_{RC}^2 + X_L^2 - \frac{2Z_{RC}X_L R}{\sqrt{R^2 + X_C^2}}}$$

$$\cos\varphi = \frac{U_{RC}\cos\varphi_{RC}}{U} = \frac{IZ_{RC}}{IZ}\frac{X_C}{\sqrt{R^2 + X_C^2}} = \frac{Z_{RC}X_C}{Z\sqrt{R^2 + X_C^2}} =$$

$$= \frac{RX_C^2}{\left(R^2 + X_C^2\right)\sqrt{\frac{R^2X_C^2}{R^2 + X_C^2} + X_L^2 - \frac{2X_LX_CR^2}{R^2 + X_C^2}}} = \frac{RX_C^2}{\sqrt{R^2 + X_C^2}\sqrt{R^2X_C^2 + X_L^2\left(R^2 + X_C^2\right) - 2X_LX_CR^2}}$$



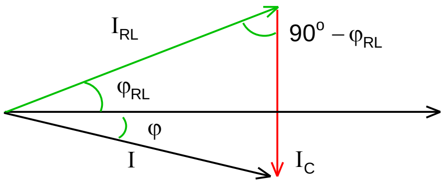
$U = U_0 \sin\omega t$



$$U = \sqrt{U_R^2 + U_L^2} \Rightarrow I_{RL}Z_{RL} = \sqrt{\left(I_{RL}R\right)^2 + \left(I_{RL}X_L\right)^2}$$

$$Z_{RL} = \sqrt{R^2 + X_L^2} \Rightarrow$$

$$\sin\varphi_{RL} = \frac{X_L}{Z_{RL}} = \frac{X_L}{\sqrt{R^2 + X_L^2}} \Rightarrow \cos\varphi_{LC} = \frac{R}{Z_{RL}} = \frac{R}{\sqrt{R^2 + X_L^2}}$$



$$I = \sqrt{I_{RL}^2 + I_C^2 - 2I_{RL}I_C\cos\left(90^o - \varphi_{RL}\right)}$$

$$\frac{U}{Z} = \sqrt{\left(\frac{U}{Z_{RL}}\right)^2 + \left(\frac{U}{X_C}\right)^2 - 2\frac{U}{Z_{RL}}\frac{U}{X_C}\sin\varphi_{RL}}$$

$$\frac{1}{Z} = \sqrt{\frac{1}{Z_{RL}^2} + \frac{1}{X_C^2} - \frac{2X_L}{Z_{RL}X_C\sqrt{R^2 + X_L^2}}}$$

$$\cos\varphi = \frac{I_{RL}\cos\varphi_{RL}}{I} = \frac{\frac{U}{Z_{RL}}\frac{R}{\sqrt{R^2 + X_L^2}}}{\frac{U}{Z}} = \frac{Z}{Z_{RL}}\frac{R}{\sqrt{R^2 + X_L^2}}$$