

Kelompok 5

Anggota: 1) Fadlyah Farah Khoirunnisa

2013022016

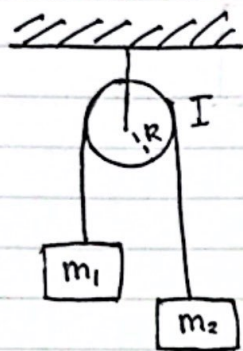
2) Bustin Wardani

2013022030

3) Elpin Nurul Rahmayani

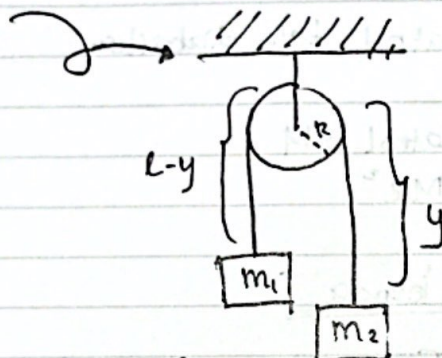
2013022038

Persamaan Lagrange pada katrol yang tidak diabaikan



panjang tali = l
massa katrol = M

$$I = \frac{1}{2} M R^2$$



$$V_1 = \frac{d(l-y)}{dt} = -\frac{dy}{dt} = -\dot{y}$$

$$V_2 = \frac{dy}{dt} = \dot{y}$$

$$T = \frac{1}{2} m_1 (-\dot{y})^2 + \frac{1}{2} m_2 (\dot{y})^2 + \frac{1}{2} I \omega^2$$

$$\omega = \frac{V}{R}$$

$$T = \frac{1}{2} m_1 \dot{y}^2 + \frac{1}{2} m_2 \dot{y}^2 + \frac{1}{2} I \left(\frac{\dot{y}}{R} \right)^2$$

$$V = -m_1 g (l-y) - m_2 g y$$

$$L = T - V = \frac{1}{2} m_1 \dot{y}^2 + \frac{1}{2} m_2 \dot{y}^2 + \frac{1}{2} I \frac{\dot{y}^2}{R^2} + m_1 g (l-y) + m_2 g y$$

$$\frac{\partial L}{\partial y} = m_1 g + m_2 g$$

$$\frac{\partial L}{\partial \dot{y}} = m_1 \dot{y} + m_2 \dot{y} + I \frac{\dot{y}}{R^2}$$

$$\frac{d}{dt} \frac{\partial L}{\partial \dot{y}} = m_1 \ddot{y} + m_2 \ddot{y} + I \frac{\ddot{y}}{R^2}$$

$$\frac{d}{dt} \frac{\partial L}{\partial \dot{y}} - \frac{\partial L}{\partial y} = 0 \rightarrow \left(m_1 + m_2 + \frac{I}{R^2} \right) \ddot{y} - (-m_1 g + m_2 g) = 0$$

$$(m_1 + m_2 + \frac{I}{R^2}) \ddot{y} - (-m_1 g + m_2 g) = 0$$

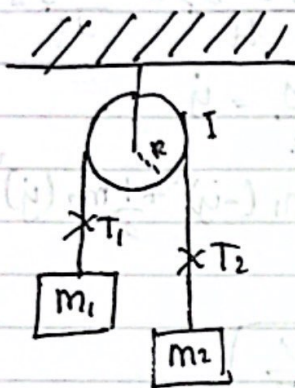
$$(m_1 + m_2 + \frac{I}{R^2}) \ddot{y} = (m_2 - m_1) g$$

$$\ddot{y} = \frac{(m_2 - m_1) g}{(m_1 + m_2 + \frac{I}{R^2})} = \frac{(m_2 - m_1) g}{m_1 + m_2 + (\frac{1}{2} \frac{MR^2}{R^2})}$$

$\therefore \ddot{y}$ = percepatan sistem

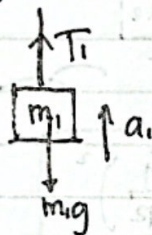
$$\ddot{y} = \frac{(m_2 - m_1) g}{(m_1 + m_2 + \frac{1}{2} M)}$$

Persamaan Newton pada katrol tak diabaikan



Masa katrol = M
 $I = \frac{1}{2} MR^2$

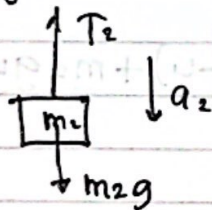
Tinjau benda 1



$$\sum F = m_1 a_1$$

$$T_1 - m_1 g = m_1 a \quad \dots 1)$$

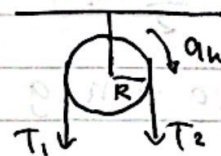
Tinjau benda 2



$$\sum F = m_2 a_2$$

$$m_2 g - T_2 = m_2 a_2 \quad \dots 2)$$

Tinjau katrol



$$\sum J = I \alpha$$

$$J_2 - J_1 = I \alpha$$

$$T_2 R - T_1 R = I \alpha$$

$$(T_2 - T_1) R = \frac{1}{2} M R^2 \cdot \frac{a_k}{R}$$

$$(T_2 - T_1) = \frac{1}{2} M a_k \quad \dots 3)$$

$$a_1 = a_2 = a_k = a$$

$$T_1 = T_2 = T$$

Eliminasi pers. 1, 2, 3

$$\cancel{X} - m_1 g = m_1 a$$

$$m_2 g - \cancel{X} = m_2 a$$

$$\cancel{X} - \cancel{X} = \frac{1}{2} M a \quad +$$

$$m_2 g - m_1 g = m_1 a + m_2 a + \frac{1}{2} M a$$

$$m_2 g - m_1 g = (m_1 + m_2 + \frac{1}{2} M) a$$

$$a = \frac{m_2 g - m_1 g}{(m_1 + m_2 + \frac{1}{2} M)}$$

$$a = \frac{(m_2 - m_1) g}{(m_1 + m_2 + \frac{1}{2} M)}$$