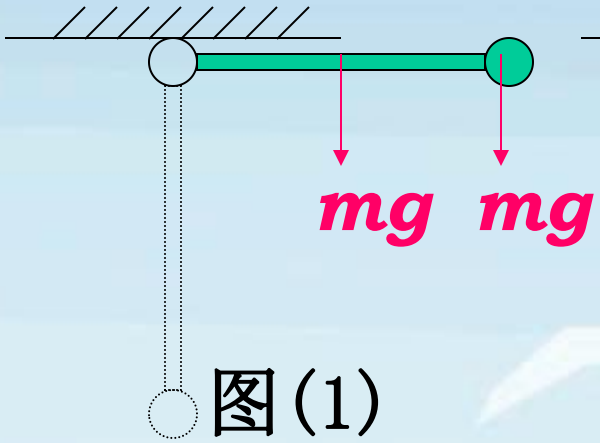
FangYi

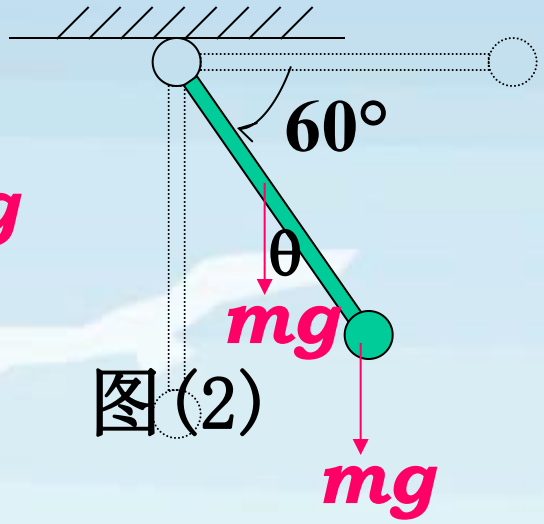
[例题3-1]均质棒m,l, 半径不计的小球m组成系统

求:图(1)α; 图(2)棒中心a_t

解(1)
$$M = mg\frac{l}{2} + mgl$$
$$J = \frac{1}{3}ml^2 + ml^2$$
$$\Rightarrow \alpha = M/J = \frac{9g}{8l}$$



图(1)



图(2)

(2)
$$M = mg\frac{l}{2}\sin 30^0 + mgl\sin 30^0 = \frac{3}{4}mgl$$
$$J = \frac{4}{3}ml^2$$
$$\alpha = M/J$$
$$a_t = \alpha(l/2)$$

$$\Rightarrow a_t = \frac{9g}{32}$$
$$a_n = \omega^2 l/2$$

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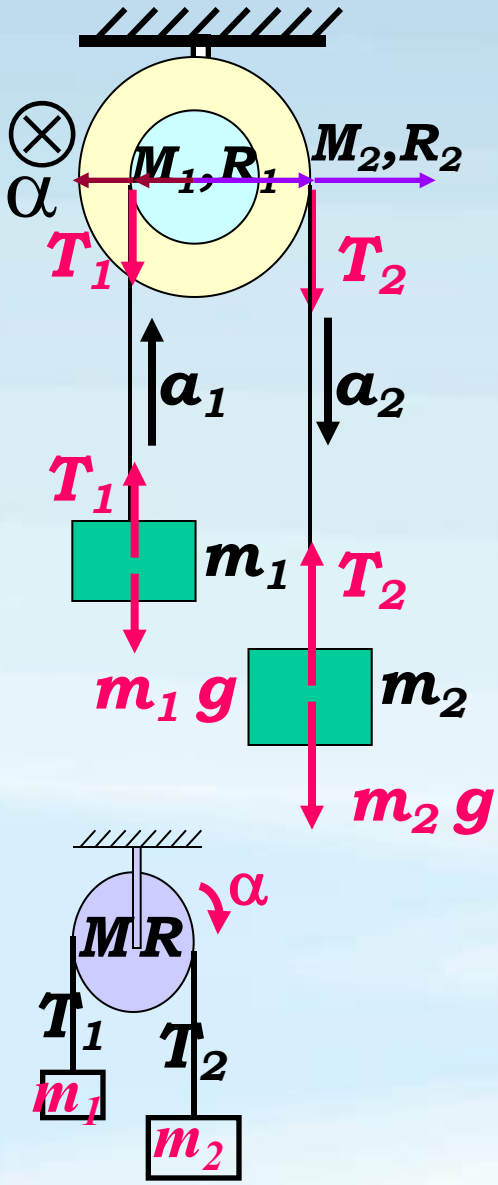
[例题3-2] 已知：$m_1<m_2$，M_1,R_1 M_2,R_2



求：α、 T_1 、T_2

解： 受力 方程

平动

$(F=ma)$

$$\begin{cases} T_1 - m_1 g = m_1 a_1 & (1) \\ m_2 g - T_2 = m_2 a_2 & (2) \end{cases}$$

转动

$(M=J\alpha)$

$$T_2 R_2 - T_1 R_1 = \left(\frac{1}{2} M_1 R_1^2 + \frac{1}{2} M_2 R_2^2\right)\alpha \quad (3)$$

判据

$$\begin{cases} a_1 = \alpha R_1 & (4) \\ a_2 = \alpha R_2 & (5) \end{cases}$$

$\Rightarrow \alpha,\ T_1,\ T_2$

由(1)、(2)、(3)、(4)、(5)解得：

$$\alpha = \frac{m_2 g R_2 - m_1 g R_1}{\frac{1}{2} M_1 R_1^2 + \frac{1}{2} M_2 R_2^2 + m_1 R_1^2 + m_2 R_2^2}$$

$$T_1 = \frac{m_1 (\frac{1}{2} M_1 g R_1^2 + \frac{1}{2} M_2 g R_2^2 + m_2 g R_2^2 + m_2 g R_1 R_2)}{\frac{1}{2} M_1 R_1^2 + \frac{1}{2} M_2 R_2^2 + m_1 R_1^2 + m_2 R_2^2}$$

$$T_2 = \frac{m_2 (\frac{1}{2} M_1 g R_1^2 + \frac{1}{2} M_2 g R_2^2 + m_1 g R_1^2 + m_1 g R_1 R_2)}{\frac{1}{2} M_1 R_1^2 + \frac{1}{2} M_2 R_2^2 + m_1 R_1^2 + m_2 R_2^2}$$