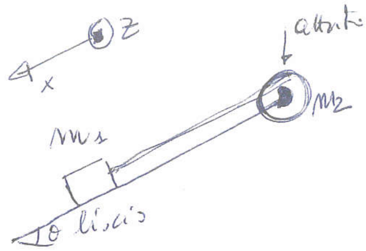
Exercise solved in the 2nd half of 2nd May lecture (on next page)

Unfortunately it is in the shape of notes for myself (in Italian and very spare shape)
Relevant information (in Italian in the text)

The surface of the inclined plane is smooth
There is friction on the constraint fixing the disc (this as explained in the theory book is just a torque of friction)
M_{Att} is the friction torque (it should be τ_k in english)
"noti" means "known quantities"
The quantities to compute are

1) the initial angular acceleration of the cylinder
2) the speed of m_1 after it went down by a distance d

In the solution W_{Att} is the work done by friction



attrito nel vincolo in G del disco

noti $m_1, m_2, R, \theta, M_{ATT}$

Calcolare 1) α

2) v dopo d

~~3) v_G dopo d~~

1) eq. del moto

$\vec{r} \times \vec{T} = RT\vec{u}_z$

$$\begin{cases} m_1 g \sin\theta - T = m_1 a \\ RT - M_{Att} = I_G \alpha \\ a = \alpha R \end{cases}$$

$\vec{a} = \vec{\alpha} \times \vec{r}$

$I_G = \frac{1}{2} m_2 R^2$

$$T = m_1 (g \sin\theta - \alpha R)$$

$$m_1 R (g \sin\theta - \alpha R) - M_{Att} = I_G \alpha$$

$$\alpha = \frac{m_1 g R \sin\theta - M_{att}}{I_G + m_1 R^2}$$

2) bilancio energetico ($E_i = 0$)

$$E_f = \frac{1}{2} m_1 v^2 + \frac{1}{2} I_G \omega^2 - m g d \sin\theta \qquad W_{att} = -M_{att}\theta = -M_{att}\frac{d}{R}$$

da $d = R\theta \Rightarrow \theta = \frac{d}{R}$

$$\Delta E_{mec} = W_{att} \Rightarrow \frac{1}{2} m_1 v^2 + \frac{1}{2} I_G \omega^2 - m_1 g d \sin\theta = -M_{att}\frac{d}{R}$$

$v = \omega R$

$$v^2 = \frac{m_1 g d \sin\theta - M_{att}\frac{d}{R}}{\frac{1}{2} m_1 + \frac{1}{2}\frac{I_G}{R^2}}$$

$$v = \sqrt{\frac{2 m_1 g R^2 d \sin\theta - 2 M_{ATT} d R}{I_G + m_1 R^2}}$$

~~3) $v_G = \frac{m_1 v}{m_1 + m_2}$~~