Theoretical Mechanics, Lab 9: DYN COM LINEAR

Theorem on the:

- Motion of the centre of Mass of a system
- Change of Linear momentum of a system

INNOPOLIS UNIVERSITY

Motion of the centre of mass of a system

R. O.	Eqn #	Equations	Applications	Extra Info
System	1–3	1. $m\vec{a}_c = \sum \vec{F};\ \vec{x}_c = \dfrac{\sum m_i \vec{x}_i}{\sum m_i}$ 2. $\dfrac{\mathrm{d}\vec{Q}_c}{\mathrm{d}t} = \sum \vec{F};\ Q_c = \sum m\vec{v}_i$	We are interested in linear motion. 1. Easy to find a displacement for a body of a system, motion equation for system, external forces. 2. Easy to find a velocities for bodies.	

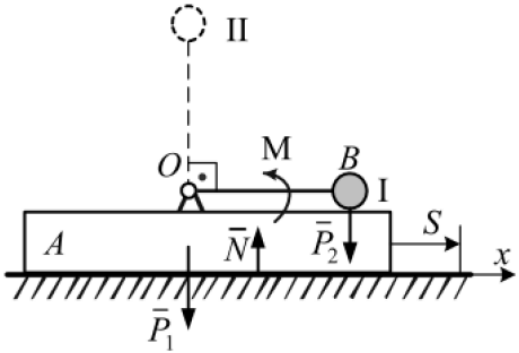
Task 1 and 2 (mine)

A system consist of body *A* (rectangular) with mass m_1 and a body *B* (ball) with mass m_2 which connected to the body *A* by rotational joint.
$OB = l = 0.2,\ m_1 = 2,\ m_2 = 0.5.$

There are 2 tasks:

1. We need to find *S* (distance), when the body *B* moved from *I* position, to *II* with applied torque *M*.

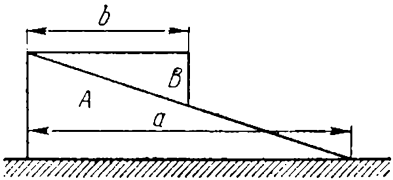
   Answer: $S = \dfrac{m_2 l}{m_1 + m_2} = 0.04$
2. We know that *B* has an angular velocity $\omega = \epsilon t$, where $\epsilon = const$. We have to find a velocity of *A*, when the body *B* reaches *II* position.



Task 3 (yours): M (rus) 35.17

546. A homogeneous prism B rests on a homogeneous prism A which is placed on a horizontal plane, as shown in Fig. 349. The cross-sections of the prisms are right triangles. The weight of the prism A is three times that of the prism B. Assuming that the prisms and the plane are perfectly smooth, determine the length l through which the prism A moves when B, which is sliding down along A, touches the plane.

Ans. $l = \frac{a-b}{4}$.



Task 4 (yours)

547. A floating crane lifts a weight $P_1 = 2000$ kgf, the jib being turned through an angle of 30° to the vertical (Fig. 350). The crane weighs $P_2 = 20{,}000$ kgf. The length of the jib is $OA = 8$ m. Determine the displacement of the floating crane. The resistance of the water and the weight of the jib should be neglected.

Ans. The crane moves a distance of 0.36 m to the left.

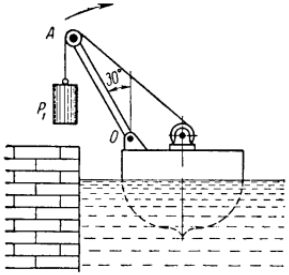


Fig. 350

Deserve “A” grade!

– Oleg Bulichev

o.bulichev@innopolis.ru

@Lupasic

Room 105 (Underground robotics lab)