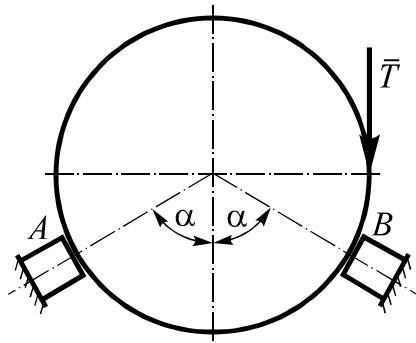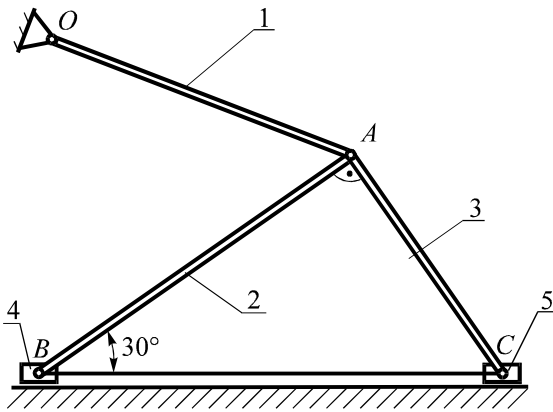# International Mechanical Engineering Contest 2011 Problems

Problem S1-2011 (10 points)
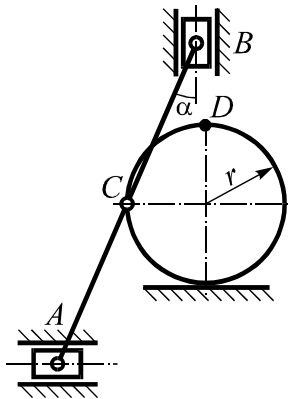
The homogeneous cylinder with weight G lies on two symmetrical to vertical supports A and B, the positions of which are defined by angles α. Coefficient of friction between the cylinder and supports is f. Find the minimum force value T to be applied to disturb the cylinder from equilibrium.
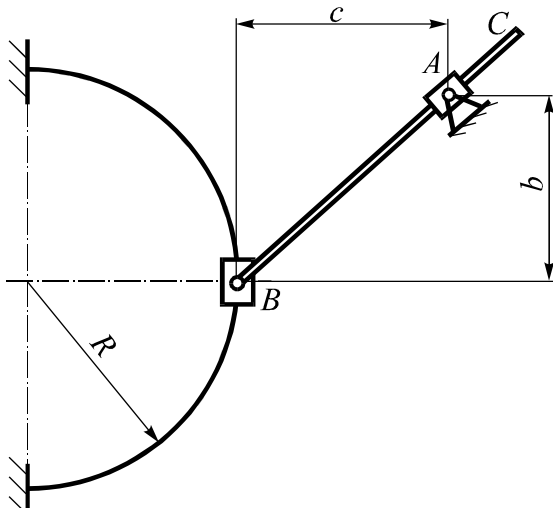
Problem S2-2011 (10 points)

Construction lies in the vertical plane. It consists of three homogeneous rods 1, 2 and 3 of the same masses which connected by hinge at point A and weightless sliders 4 and 5 tied together by the inextensible cord. Define the ratio between the largest of the three forces of rods acting on hinge A and the smallest analogous force.
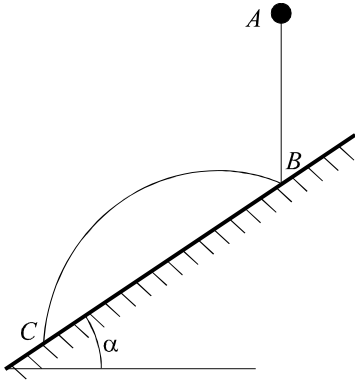
Problem K1-2011 (10 points)

At this moment point A of coupler link AB with length $2l$ has the velocity v_A and zero acceleration. Now the coupler link is at angle α with vertical. The coupler link is pivotally connected by its central point to the disc which constantly contacts the horizontal plane during the process of motion. Accepting that the radius of the disc is r, define the velocity and acceleration of point D.
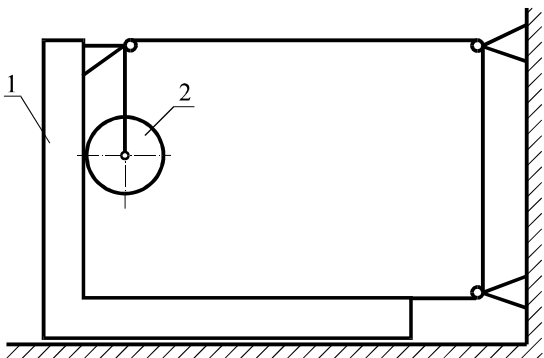
Problem K2-2011 (10 points)

Slider B is moving along the arc of the circle with radius R. In the depicted position of the mechanism acceleration of point B is BC-guided and is equal a. Find for this position the velocity and acceleration of point C if parameters b, c are given and $BC = l$.
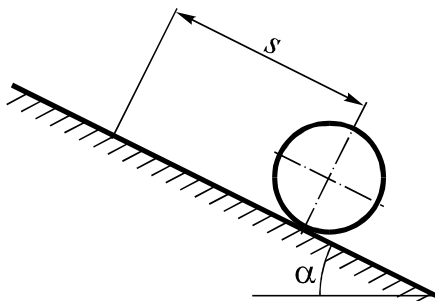
Problem D1-2011 (10 points)

The ball falls down on the inclined plane with the horizontal angle α from the position A without initial velocity. Bouncing at point B it falls to such point C that $BC = l$. Considering the impact as absolutely elastic and ignoring air resistance define ball AB-section travelling time.
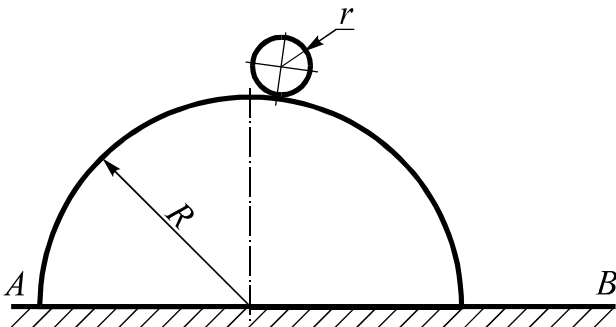
Problem D2-2011 (10 points)

Platform 1 with mass m_1 is riding on the smooth horizontal surface. The homogeneous disc 2 with mass m_2 is rolling on its vertical-way flatness. The platform and disc are connected by weightless rope-pulley system where there is no friction between the rope and construction units. Find the minimum value for the coefficient of friction between the disc and platform when the rolling occurs without slipping.

Problem D3-2011 (10 points)

The solid homogeneous cylinder with radius r rotating with angular velocity ω_0 is placed on the inclined plane with horizontal angle α and it starts rolling uphill. Initial velocity of its center is zero. Coefficient of friction between the cylinder and plane is f. Define what maximum distance s the cylinder centre goes uphill along the inclined plane.

Problem D4-2011 (10 points)

The homogeneous cylinder with radius r starts rolling down from the top-point of the immovable semi-cylinder with radius $R = 6r$ with negligibly small initial velocity. The rolling of the cylinder is without any slipping. What velocity for the cylinder point which initial contact with AB plane will be immediately before the impact?