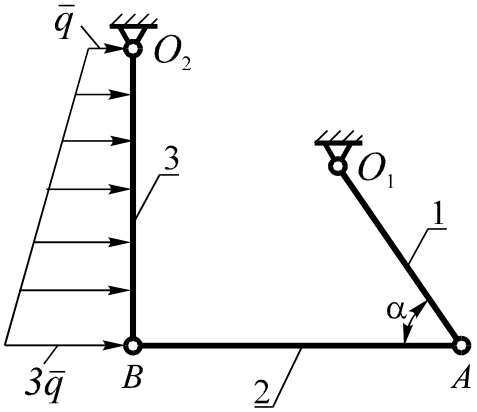
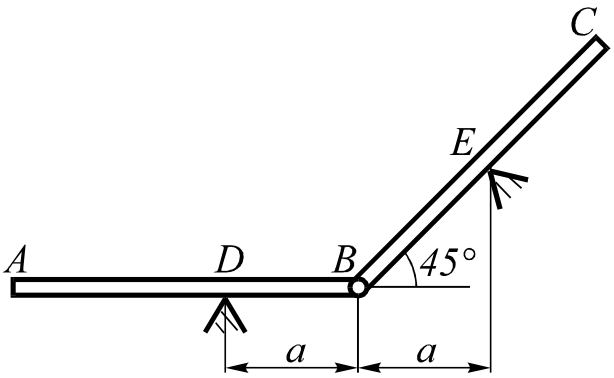
International Engineering Mechanics Contest 2012
Problems

Problem S1-2012



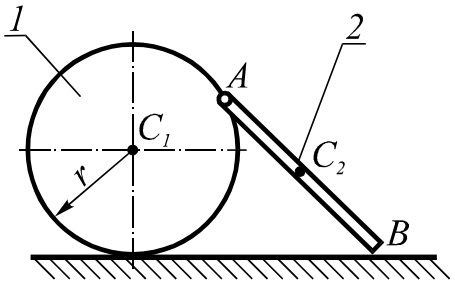
In the bar system placed in the vertical plane the homogeneous rods 1, 2 and 3 have lengths l_1, l_2, l_3 and gravity forces G_1, G_2, G_3 respectively. In equilibrium position rod AB is horizontal, rod O_2B is vertical and the angle between rods O_1A and AB is α. Define the value q for the intensity of the distributed load with linear variation when the given equilibrium position of system is provided.

Problem S2-2012



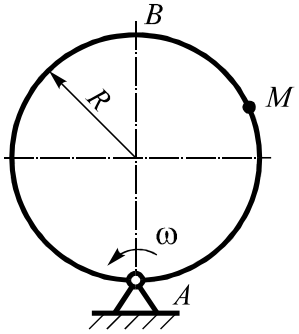
Two homogeneous rods AB and BC with the same masses are connected by hinge at point B and placed on two rough edges D and E. Define the rod lengths when the equilibrium in the depicted position is possible if the coefficient of friction between the rods and supports is f, and size a is also known.

Problem K1-2012



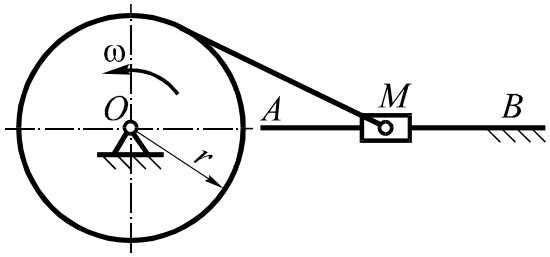
Disk 1 with radius r is rolling along the horizontal surface without slipping so that the speed of its centre C_1 is constant. Rod 2 with length $2r$ is hinged to point A of the disk rim, rod end B is sliding along the surface. Define how many times the speed of C_2 rod centre is higher than the speed of C_1 disk centre at the moment when point A is at its highest position.

Problem K2-2012



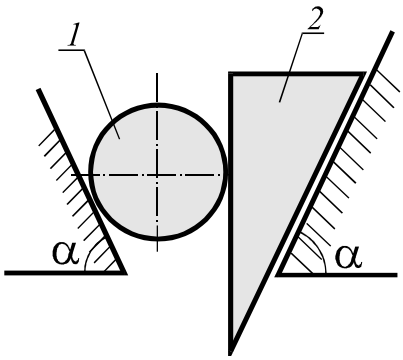
Disk with radius R is rotating about the motionless axis with the constant angular velocity ω. Along the disk rim particle M is moving from A to B with constant relative velocity $v_r = \sqrt{3}\omega R$. Define the radius of path curvature for the absolute motion of particle M in the position when the relative and transport velocities are the same.

Problem D1-2012



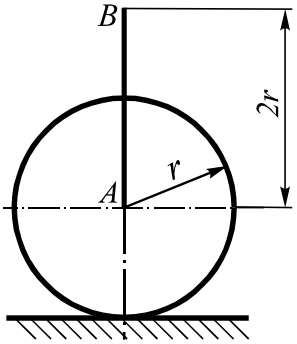
The pulley with radius r is rotating about its axis with the constant angular velocity ω. The pulley is wound with the thread to the free end of which slider M is attached. The slider with mass m is moving along rod AB the extension of which crosses the pulley axis at right angle at point O. The coefficient of friction between the slider and the rod is f. Define the thread tension force with distance $OM = x$.

Problem D2-2012



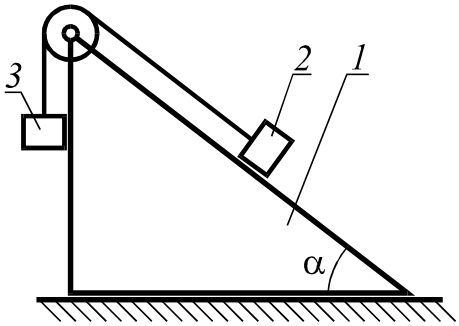
Cylinder 1 with mass m_1 and wedge 2 with mass m_2 touching each other are moving between two inclined surfaces forming the identical angles α with the horizon. The frictions between the cylinder and the wedge as well as between the wedge and the surface are negligibly small. The cylinder is rolling along the inclined surface without slipping. Define what force the cylinder applies on the wedge.

Problem D3-2012



The homogeneous disk with radius r is fastened with thin homogeneous rod AB. The disk and rod have the same masses. In the depicted position the quiescent system begins to move under the gravity forces. Ignoring the friction between disk and surface define the velocity of rod end B at the moment of the impact against the surface.

Problem D4-2012



Prism 1 with mass m_1 may slide along the smooth horizontal surface. Two loads 2 and 3 with masses m_2 and m_3 ($m_2 \sin\alpha > m_3$) are connected by inextensible thread and sliding along the inclined and vertical prism faces respectively and the friction between load 2 and the prism is negligibly small. The coefficient of friction between load 3 and the prism face is f. Define the acceleration for prism 1. Block weight can be ignored. Angle α is known.