Problem S1–2021
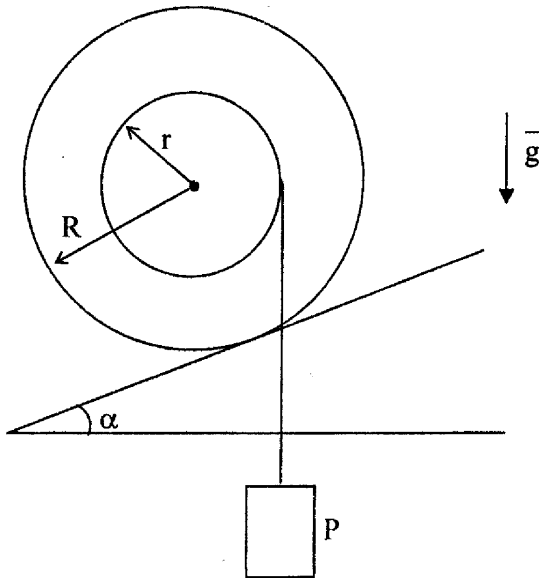
A stepped block whose radii are r and R, and the force of gravity is G, is located on an unsmooth inclined plane. A thread is wound on the inner step of the block; a load is suspended to the end of the thread. The coefficient of friction of adhesion between the block and the plane is f.

1. Find at what values of the angle α it is possible to ensure the equilibrium of the block in the position shown in the figure if there is no rolling resistance.

2. Determine the values of the force P at which the block will be in equilibrium at a given value of the angle α, if the rolling friction coefficient is δ.

Problem S2–2021
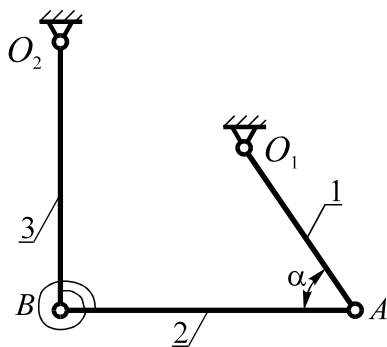
In a rod system located vertically, rods 1, 2, and 3 have lengths l_1, l_2, l_3 and weights P_1, P_2, and P_3, respectively. Rods 2 and 3 are connected by a spiral spring, which ensures the balance of the system in the position shown in the figure, in which the rod AB is horizontal.

$$\angle O_1 AB = \alpha, \quad \angle O_2 BA = \frac{\pi}{2}$$

Determine the moment developed by the spring and the reaction of the hinge B.

Problem K1–2021
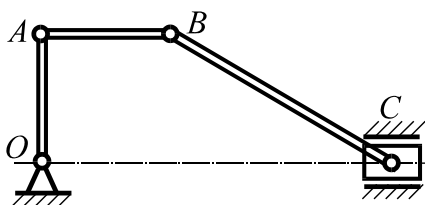
The presented mechanism includes rods *OA* and *AB* of the same length and a rod *BC*, which is twice longer. Velocities of points *A* and *C* are equal by modulo, constant and at the demonstrated time moment they are directed in the opposite sides.

At the shown time moment the rod *OA* is vertical, the rod *AB* is horizontal. Find the relationship of the angular velocities and angular accelerations of the rods *AB* and *BC*.

Problem K2–2021
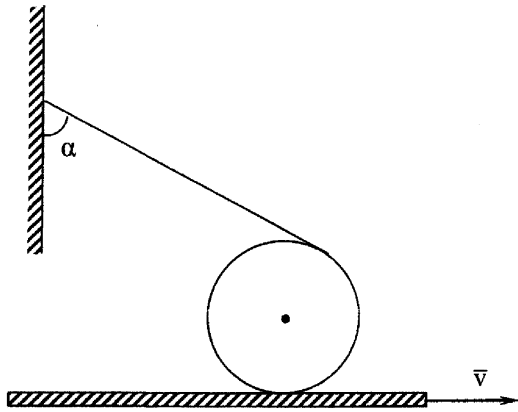
A cylinder of radius r is wrapped by a thread. The second end of the thread is connected to a vertical wall. The cylinder is placed on a horizontal desk moving translationally along the horizontal direction with a constant Velocity v. There is no slipping between the cylinder and the desk.

Determine velocity and acceleration of the cylinder axis depending on the angle α and angular velocity, angular acceleration of the thread.

Problem D1–2021
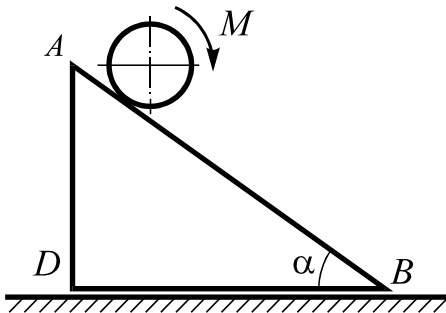
The triangle prism of mass 2m is placed on the smooth horizontal plane. An angle at a base of the prism is α. On the edge AB of the prism a solid homogeneous cylinder of mass m and radius r rolls under the action of moment M. The friction coefficient between the cylinder and the prism is f.

Find the force of prism pressure on the horizontal plane.

Problem D2–2021
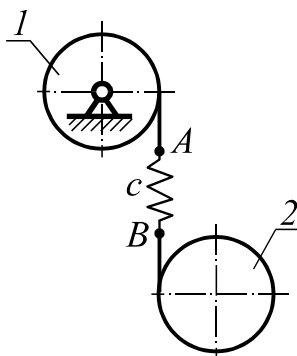
Homogeneous disks 1 and 2 have the same mass m and radii r. The discs are in the vertical plane. The discs are linked by a vertical inextensible thread with an elastic part AB having the coefficient of elasticity c. At initial moment the system rested and the spring AB was unstretched.

Define the maximal angular acceleration of the disc 1 at its movement and the time moment when the angular acceleration reaches its maximal value the first time.