# 2019 INTERNATIONAL ENGINEERING MECHANICS CONTEST (ASIAN REGION)
The Theory Contest

Problem S-1
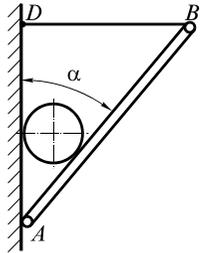
A uniform heavy cylinder touches a vertical wall and it is held in the equilibrium by two horizontal cables **BD** and two weightless rods **AB** that are pivotally attached to the wall. At what value of the angle α the tension of the cables will be the minimal?

Problem S-2
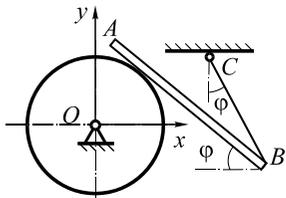
A thin homogeneous rod **AB** of length $2r$ rests on a rough disk of radius r. The rod is held in balance by a weightless thread **CB** of length r. Determine the coordinates of the point **C** that is the attachment point of the thread, if the rod **AB** is inclined to the horizontal and **BC** - to the vertical at an angle φ. The friction in the hinge can be neglected.

Problem K-1
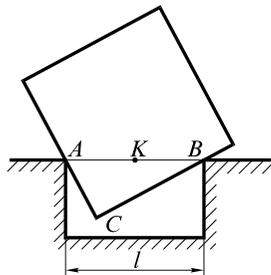
The rectangular plate moves in its plane with a constant angular velocity ω. Determine the velocity and acceleration of the plate top **C** and of the plate point **K** that is the midpoint of the section **AB**. **AB** $= l$.

Problem K-2
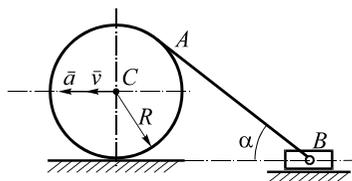
The disk of radius R rolls without sliding along a fixed plane. The velocity and the acceleration of the disk center at a given time are v and a respectively. The thread **AB** is wound on the disk. Determine the velocity and the acceleration of the thread end **B** if the thread makes an angle α with the plane.

Problem D-1
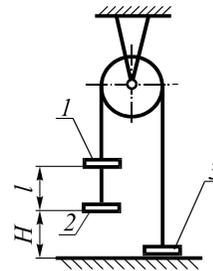
The loads 1, 2, 3 are connected by a weightless inextensible thread thrown over a block of radius r and they have the same mass m. The dimensions of the loads can be neglected. The system starts to move without the initial velocity from the position shown in the figure. The dimensions H and l are given. At what maximal height will the load 3 rise, if the axial moment of inertia of the block is equal to mr^2, and the loads 1 and 2 remain stationary after reaching the floor?

Problem D-2
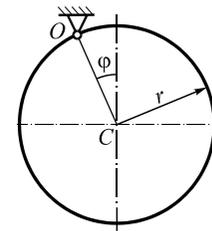
A non-uniform disk of radius r oscillates in a vertical plane around the axis **O**. The density of the disk is proportional to the distance to the axis **C**, passing through the center of the disk. Determine the period of small oscillations of the disk.

Problem D-3
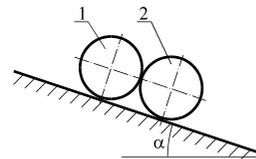
A rough uniform cylinder 1 and a thin pipe 2 of the same radii and masses, roll without slipping along a rough inclined plane forming an angle α with the horizon. The coefficient of sliding friction between the cylinders is f. Determine the acceleration of the centers of the cylinders of rolling bodies.

Problem D-4
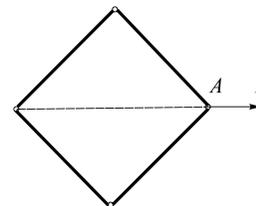
Four homogeneous rods of length l and mass m each are connected by hinges and form a square located on a smooth horizontal plane. The force F was applied to a hinge **A** in the shown direction. Before the force application the system rested. Determine the hinge **A** acceleration at the initial movement moment.