

Task 4

Simulate objects rolling on an inclined plane using the midpoint method for calculations

The simulation should be carried out for two different objects, e.g. sphere and sphere

The simulation results should be presented in the form of a graph of the center of mass and rotation angle (optional plot of potential, kinetic and total energy)

No animation is required

Equations describing the linear motion of the center of mass:

$$\begin{cases} \frac{ds}{dt} = v \\ \frac{dv}{dt} = a \end{cases}$$
$$a = \frac{g \sin(\alpha)}{1 + \frac{I}{mr^2}}$$

α slope of inclination

I inertia

$$I_b = \frac{2}{5}mr^2 \quad I_d = \frac{2}{3}mr^2$$

Equations describing rotational motion:

$$\begin{cases} \frac{d\beta}{dt} = \omega \\ \frac{d\omega}{dt} = \varepsilon \quad \varepsilon = \frac{a}{r} \end{cases}$$