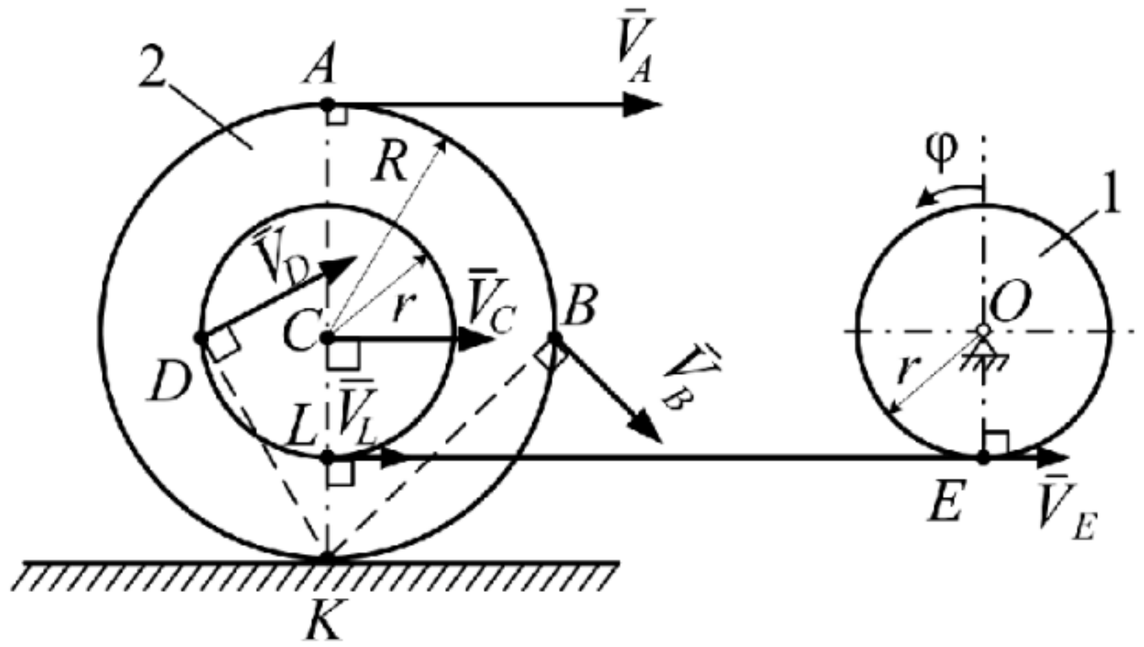
The shaft **1** has radius $r = 0.1$. It rotates around O axis by law $\varphi = \varphi(t) = 2t$. Step roller **2** with radii $R = 0.2$, $r = 0.1$ associated with the shaft, wrapped in an unbreakable rope and rolling without sliding over horizontal plane.



Determine the velocities of points A, B, C, D, K and angular velocity of ω_2.

Lab 3, Task 1

We should operate with velocities → $\varphi \rightarrow \omega$

$\dot{\varphi} = \omega = 2$

$V_E = \omega_1 r$

ω_1 — pseudovector, its positioned up (in 3D)

Because the rope is unbreakable -> $V_E = V_L$

TIP:
Don't forget that 2nd part of equations are cross product in general.
It helps to find velocity direction correctly.

Let's use IC approach

$V_K = 0$ → 1st rule of IC

$\bar{V}_L = \bar{V}_K + \bar{V}_{LK}$ $\quad \bar{V}_{LK} \perp \omega_2 (R-r)$

$\bar{V}_C = \bar{V}_K + \bar{V}_{CK}$ $\quad \bar{V}_{CK} \perp \omega_2 CK = \omega_2 R$

$\Rightarrow \omega_2 = 2$

$\Rightarrow 0.4$

$V_D = V_K + V_{DK}$ $\quad V_{DK} \perp \omega_2 \sqrt{2} R$

$\Rightarrow 0.57$

$V_A = V_K + V_{AK}$ $\quad V_{AK} \perp \omega_2 2R$

$\Rightarrow 0.8$

$V_D = V_K + V_{DK}$ $\quad V_{DK} \perp \omega_2 \sqrt{R^2 + r^2}$

$\Rightarrow 0.45$