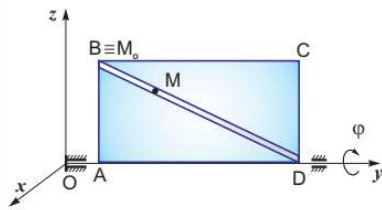


### Zadatak 1.61

Pravougaona ploča stranica  $\overline{AB} = \overline{CD} = R$  i  $\overline{AD} = \overline{BC} = R\sqrt{3}$  može da se obrće oko horizontalne ose  $Oy$  po zakonu  $\varphi = 2\pi t^2$  u smeru prikazanom na slici 1.131 (matematički negativan smer). Istovremeno, polazeći iz tačke  $B$  se po dijagonali  $\overline{BD}$  ploče kreće tačka  $M$  po zakonu  $s = Rt^3$ .



Slika 1.131: uz zadatak 1.61.

Odrediti intenzitet apsolutne brzine i apsolutnog ubrzanja tačke  $M$  u trenutku  $t_1 = 1$  [s].

■ **Rešenje 1.61** Potrebni elementi za izračunavanje brzina i ubrzanja:

$$\overline{BD} = \sqrt{R^2 + 3R^2} = 2R,$$

$$\sin \alpha = \frac{\overline{AB}}{\overline{BD}} = \frac{1}{2} \Rightarrow \alpha = 30^\circ, \quad d_1 = \overline{M_1D} \sin \alpha = \frac{R}{2}.$$

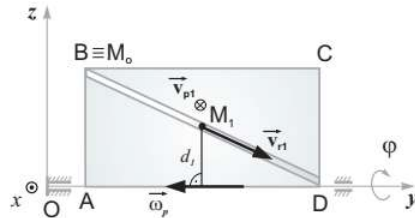
$$\varphi = 2\pi t^2, \quad \dot{\varphi} = 4\pi t, \quad \ddot{\varphi} = 4\pi,$$

$$\varphi_1 = 2\pi, \quad \dot{\varphi}_1 = 4\pi, \quad \ddot{\varphi}_1 = 4\pi.$$

$$s = Rt^3, \quad \dot{s} = 3Rt^2, \quad \ddot{s} = 6Rt,$$

$$s_1 = R, \quad \dot{s}_1 = 3R, \quad \ddot{s}_1 = 6R.$$

Brzine:



Slika 1.132: Brzina.

$$\mathbf{v}_a = \mathbf{v}_r + \mathbf{v}_p,$$

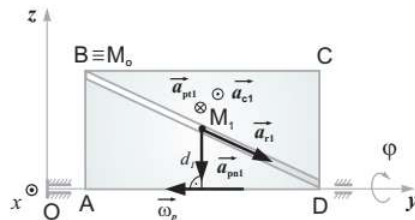
$$v_r = \dot{s} \Rightarrow v_{r1} = \dot{s}_1 = 3R,$$

$$v_p = d \cdot \omega_p = d \cdot \dot{\varphi} \Rightarrow$$

$$v_{p1} = d_1 \cdot \dot{\varphi}_1 = 2R\pi,$$

$$v_{a1} = \sqrt{v_{r1}^2 + v_{p1}^2} = R\sqrt{9 + 4\pi^2}.$$

Ubrzanja:



Slika 1.133: Ubrzanje.

$$\mathbf{a}_a = \mathbf{a}_r + \mathbf{a}_p + \mathbf{a}_{cor} =$$

$$= \mathbf{a}_r + \mathbf{a}_{pn} + \mathbf{a}_{pt} + \mathbf{a}_{cor},$$

$$a_{r1} = \ddot{s}_1 = 6R,$$

$$a_{pn1} = d_1 \cdot \omega_{p1}^2 = d_1 \cdot \dot{\varphi}_1^2 = 8R\pi^2,$$

$$a_{pt1} = d_1 \cdot \varepsilon_1 = d_1 \cdot \ddot{\varphi}_1 = 2R\pi,$$

$$a_{cor} = 2\omega_p \cdot v_p \sin \alpha = 2\dot{\varphi} \cdot v_p \sin \alpha \Rightarrow$$

$$a_{cor1} = 2\dot{\varphi}_1 \cdot v_{p1} \sin \alpha = 12R\pi.$$

$$a_{ax1} = -a_{pt1} + a_{cor1} = 10R\pi,$$

$$a_{ay1} = a_{r1} \cos 30^\circ = 3R\sqrt{3},$$

$$a_{az1} = -a_{r1} \sin 30^\circ - a_{pn1} = -3R - 8R\pi^2 = -R(3 + 8\pi^2)$$

$$a_{a1} = \sqrt{a_{ax1}^2 + a_{ay1}^2 + a_{az1}^2} \approx 88R.$$