28. М 19.13

30 августа 2025 г. 16:35

Дано.

$M_1 = (0; 0; 2)$

$V_{x_1} = 1$ м/с

$V_{y_1} = 2$ м/с

$V_{z_1} = 0$

$M_2 = (0; 2; 2)$

$\cos\alpha = -\frac{2}{3}$

$\cos\beta = \frac{2}{3}$

$\cos\gamma = -\frac{1}{3}$

$w_x, w_y, w_z = ?$

$w = ?$

Решение

$\vec{w} \times \vec{r} = 0$

$$\begin{bmatrix} i & j & k \\ w_x & w_y & w_z \\ x & y & z \end{bmatrix} \quad \begin{cases} w_y z - y w_z = 0 \\ w_x z - x w_z = 0 \\ w_x y - x w_y = 0 \end{cases}$$

$$\begin{cases} V_x = w_y z - y w_z = 1 \\ V_y = -w_x z + x w_z = 2 \\ V_z = w_x y - x w_y = 0 \end{cases} \Leftrightarrow \begin{cases} w_y = \frac{1}{2} \\ w_x = 1 \end{cases}$$

$$\begin{cases} V_{x_2} = V_2 \cos\alpha = -\frac{2}{3} V_2 \\ V_{y_2} = V_2 \cos\beta = \frac{2}{3} V_2 \\ V_{z_2} = V_2 \cos\gamma = -\frac{1}{3} V_2 \end{cases} \Leftrightarrow \begin{array}{l} w_y 2 - w_z = -\frac{2}{3} V_2 \\ -w_x 2 + 0 = \frac{2}{3} V_2 \\ w_x 1 - 0 = -\frac{1}{3} V_2 \end{array} \Leftrightarrow$$

$$\Leftrightarrow \begin{cases} 1 - w_z = -\frac{2}{3} V_2 \\ 2 = \frac{2}{3} V_2 \end{cases} \Leftrightarrow \begin{array}{l} 1 - w_z = -2, \Rightarrow \\ \Rightarrow w_z = 3, \Rightarrow V_2 = 3 \text{ м/с} \end{array}$$

$$w = \sqrt{w_x^2 + w_y^2 + w_z^2} = \sqrt{1 + \frac{1}{4} + 9} = \sqrt{10{,}25} \approx 3{,}2 \text{ рад/с}$$