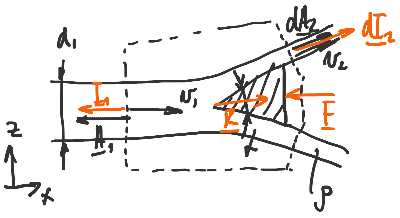
Problem 4-5

2022. április 8., péntek 12:42



$d_1 = 20\,mm$

$v_1 = 10\,m/s$

$\rho = 13600\,kg/m^3$

$\alpha = 60°$

$F = ?$

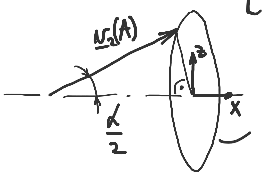
$$\int_A \underline{v}\,\rho\,\underline{v}\,d\underline{A} = \int_V \underline{g}\,dV - \int_A p\,d\underline{A} - \underline{R}$$

$\underline{I}_1 + \underline{I}_2$ | 0 (text) | $p_0 \int_A d\underline{A} = 0$

$$\underline{I}_1 = \underline{v}_1(\rho \underline{v}_1 \underline{A}_1) = \begin{bmatrix} -v_1 q_{m1} \\ 0 \end{bmatrix}$$

The solid body is a cone. A_2 is a 3D surface with changing $\underline{v}_2$ directions!

$$\underline{I}_2 = \int_{A_2} d\underline{I}_2 = \int_{A_2} \underline{v}_2(A)\,\rho\,\underline{v}_2(A)\,d\underline{A} = \begin{bmatrix} v_2 \cos\left(\frac{\alpha}{2}\right) q_{m2} \\ 0 \end{bmatrix}$$



in the z direction, the integral along this circle is 0

$$\underline{R} = \begin{bmatrix} R_x \\ R_z \end{bmatrix}$$

⊗: $-v_1 q_{m1} + v_2 \cos\left(\frac{\alpha}{2}\right) q_{m2} = -R_x$

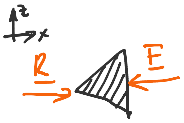
(v_1 = q_{m1} by BE1-2 Cont.)

ⓩ: $0 = -R_z$

$R_z = 0$

$$R_x = v_1 q_{m1} \left(1 - \cos\frac{\alpha}{2}\right) = 57.2\,N$$

($q_{m1} = \rho v_1 \frac{d_1^2 \pi}{4}$)



$\underline{R} + \underline{F} = \underline{0}$

⊗: $R_x - F = 0$

$F = 57.2\,N$