M R

Ahmed Mahdy

فيزياء	استاتيكا
دوائر كهربية	الكـــترونيات
ميكانيكا الانشائات	هيدروليكا

مدرس خصوصي

اونلاين حضوري

يحصل الطالب علي

- مقاطع فيديوهات لشرح المقرر بشكل وافي
- ملخص للمادة Pdf للمذكرة والمراجعة
- محاضرات مباشرة علي برنامج زووم لمناقشة الأجزاء الغير مفهومة
- تواصل مستمر مع معلم المادة

للتواصل

0567630097

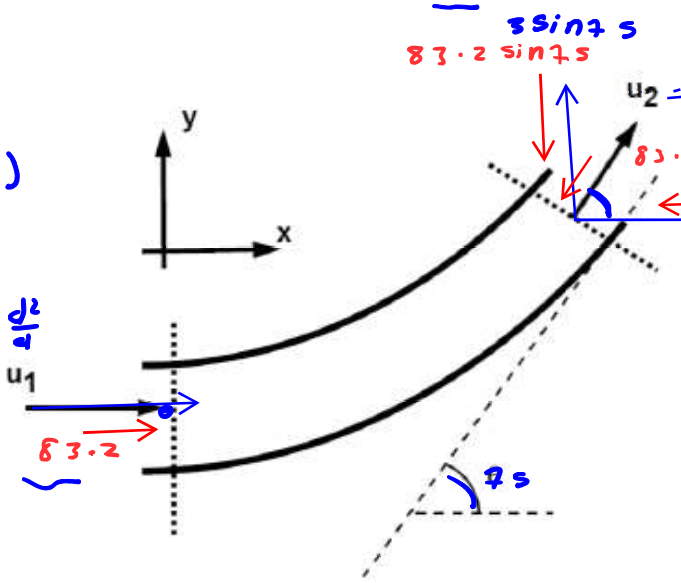
0565657741

Solved Examples

(Momentum Equation)

Example 1

A 600mm diameter pipeline carries water under a head of 30m with a velocity of 3m/s. This water main is fitted with a horizontal bend which turns the axis of the pipeline through 75° (i.e. the internal angle at the bend is 105°). Calculate the resultant force on the bend and its angle to the horizontal.



$\Sigma f = f_T = \rho Q (v_2 - v_1)$

$A = \pi d^2 = \pi \left(\frac{d}{2}\right)^2 = \pi \frac{d^2}{4}$

$Q = A \cdot v$

$= \pi + \frac{0.6^2}{4} * 3$

$Q = 0.848 m^3/s$

$P = \rho g h$

$= 1000 \times 9.81 \times 30$

$= 294300 Pa$

$f_p = P A$

$= 294300 \times \pi \frac{0.6^2}{4}$

$= 83.2 kN$

$f_T = \rho Q (v_2 - v_1)$

$f_{T_x} = 1000 \times 0.848 (3 \cos 75 - 3) = -1.886 kN$

$\Sigma f_y = f_T = \rho Q (v_{y2} - v_{y1}) = 1000 \times 0.848 (3 \sin 75)$

$f_{T_y} = 2.457 kN$

$f_{T_x} = f_{R_x} + f_{p_x} + f_{b_x}$

$-1.886 = f_{R_x} + 83.2 - 83.2 \cos 75 \Rightarrow f_{R_x} = 63.6 kN$

$\Sigma f_y = 2.457 = f_{By} + R_{Py}$

$2.457 = f_{By} + (-83.25\sin 25)$

$f_{By} = 82.82\ kN$

the force in the fluid

$f_{Bx} = 63.6, \quad f_{By} = -82.82$

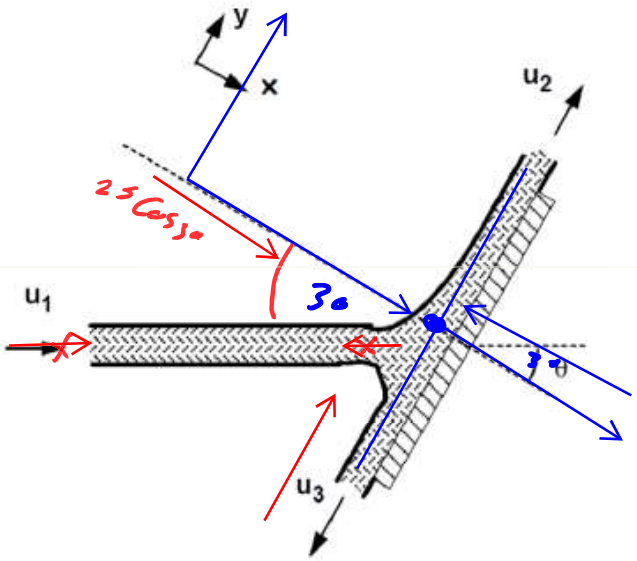
$f_B = \sqrt{63.6^2 + 82.82^2} = 104.42\ kN \quad \theta = \tan^{-1}\left(\frac{-82.82}{63.6}\right) = -52.5^\circ$

Example 2

A 75mm diameter jet of water having a velocity of 25m/s strikes a flat plate, the normal of which is inclined at 30°to the jet. Find the force normal to the surface of the plate.

$A = \frac{\pi d^2}{4} = \pi \times \frac{175 \times 10^{-3}}{4} = 4.42 \times 10^{-3} m^2$

$Q = A \cdot V = 0.11\ m^3/s$



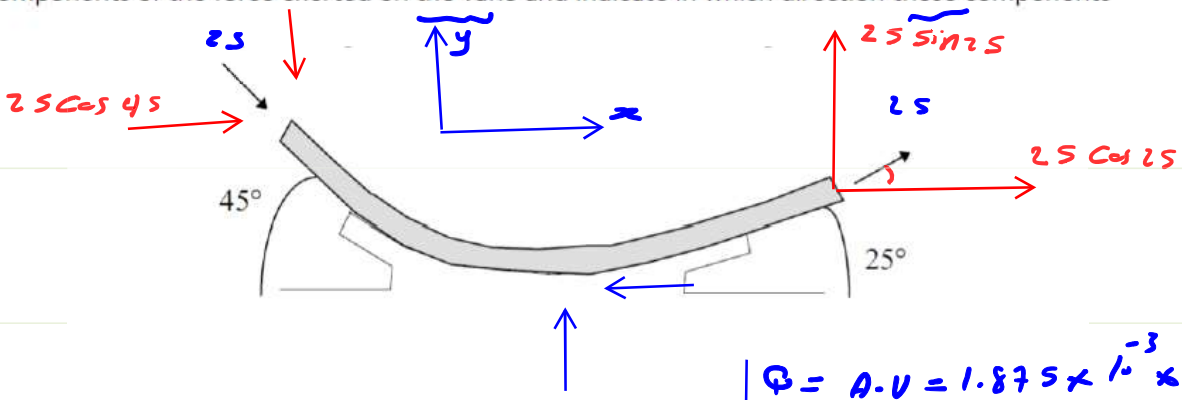
$f_x = \rho Q (u_2 - u_1) = 1000 \times 0.11 (0 - 25\cos 30)$

$f_x = -2.38\ kN$

$f_x + f_{p1} + f_{p2} = -2.38\ kN$

Example 3

The figure below shows a smooth curved vane attached to a rigid foundation. The jet of water, rectangular in section, 75mm wide and 25mm thick, strike the vane with a velocity of 25m/s. Calculate the vertical and horizontal components of the force exerted on the vane and indicate in which direction these components act.



$A = 75 * 10^{-3} * 25 * 10^{-3} = 1.875 * 10^{-3} m^2$

$Q = A.V = 1.875 * 10^{-3} * 25$

$Q = 46.875 * 10^{-7} m^3/s$

$F_x = \rho Q (V_{2x} - V_{1x})$

$1000 * 46.875 * 10^{-3} (25 \cos 25 - 25 \cos 45)$

$F_x = 233.44 N$

$F_y = \rho Q (V_{2y} - V_{1y})$

$1000 * 46.875 * 10^{-3} (-25 \sin 25 + 25 \sin 45)$

$F_y = -333.38 N$

$R_x = -233.44 N$ $R_y = 333.38 N$