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Finally I get this ebook, thanks for all these I can get now!

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Cool! I'am really happy

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My friends are so mad that they do not know how I have all the high quality ebook which they do not!

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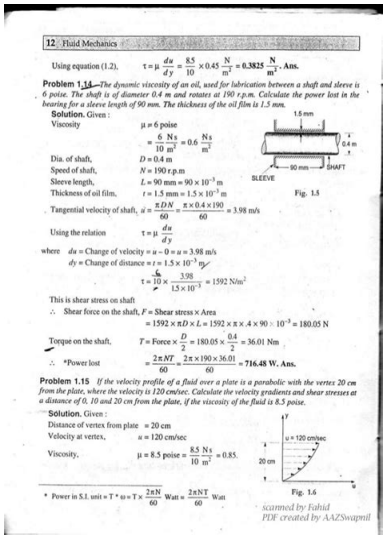
so many fake sites. this is the first one which worked! Many thanks



12 Fluid Mechanics

Using equation (1.2), $\tau = \mu \frac{du}{dy} = \frac{8.5}{10} \times 0.45 \frac{N}{m^2} = 0.3825 \frac{N}{m^2}$. Ans.

Problem 1.14 *The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm.*

Solution. Given :

Viscosity $\mu = 6$ poise $= \frac{6}{10} \frac{Ns}{m^2} = 0.6 \frac{Ns}{m^2}$

Dia. of shaft, $D = 0.4$ m

Speed of shaft, $N = 190$ r.p.m

Sleeve length, $L = 90 \text{ mm} = 90 \times 10^{-3}$ m

Thickness of oil film, $t = 1.5 \text{ mm} = 1.5 \times 10^{-3}$ m

Fig. 1.5

Tangential velocity of shaft, $u = \frac{\pi DN}{60} = \frac{\pi \times 0.4 \times 190}{60} = 3.98$ m/s

Using the relation $\tau = \mu \frac{du}{dy}$

where du = Change of velocity $= u - 0 = u = 3.98$ m/s

dy = Change of distance $= t = 1.5 \times 10^{-3}$ m

$\tau = 10 \times \frac{3.98}{1.5 \times 10^{-3}} = 1592$ N/m^2

This is shear stress on shaft

∴ Shear force on the shaft, F = Shear stress × Area

$= 1592 \times \pi D \times L = 1592 \times \pi \times .4 \times 90 \times 10^{-3} = 180.05$ N

Torque on the shaft, T = Force × $\frac{D}{2} = 180.05 \times \frac{0.4}{2} = 36.01$ Nm

∴ *Power lost $= \frac{2\pi NT}{60} = \frac{2\pi \times 190 \times 36.01}{60} = 716.48$ W. Ans.

Problem 1.15 *If the velocity profile of a fluid over a plate is a parabolic with the vertex 20 cm from the plate, where the velocity is 120 cm/sec. Calculate the velocity gradients and shear stresses at a distance of 0, 10 and 20 cm from the plate, if the viscosity of the fluid is 8.5 poise.*

Solution. Given :

Distance of vertex from plate = 20 cm

Velocity at vertex, $u = 120$ cm/sec

Viscosity, $\mu = 8.5 \text{ poise} = \frac{8.5}{10} \frac{Ns}{m^2} = 0.85$.

Fig. 1.6

* Power in S.I. unit = $T \times \omega = T \times \frac{2\pi N}{60}$ Watt $= \frac{2\pi NT}{60}$ Watt

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