Aerodynamics-TD4

Viscid and Incompressible Flow

Exercise 1： Pipe flow

The water and the oil flow in the pipes.

Flow speed: $V = 0.5 m/s$

Pipes' diameter: $d = 100mm$

Viscidity coefficient: $v_{water} = 1.79 \times 10^{-6} m^2/s$, $v_{oil} = 30 \times 10^{-6} m^2/s$

1. Determine flow models (Laminar or turbulence).

2. Calculate the maximum velocity of flow, if the pipes are rectangular pipes and the flow models keep laminar.

Rectangle width: $B = 10mm$

Rectangle length: $H = 15mm$

Exercise 2： Plate flow

The figure below is a cylindrical sliding bearing, and between the shaft and bearing is oil. Determine: (a) The shaft torque T_s ; (b) The shaft power W_s .

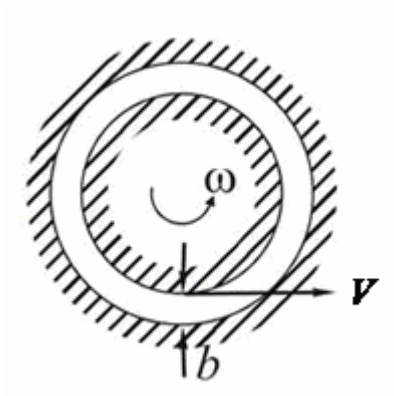
Shaft diameter: $d = 80mm$

Shaft length: $l = 30mm$

Shaft speed: $n = 3600 n/\min$

The clearance between shaft and bearing: $b = 0.06mm$

Viscidity coefficient of the oil: $\mu = 0.12 Pa \cdot s$



Exercise 3： Plane Flow

Velocity distribution in a viscid and incompressible flow is:

$$\begin{cases} V_x = Ax \\ V_y = -Ay \end{cases} \qquad A = Cons$$

Determine:

1. Stress p_{xx}, p_{yy}, τ_{xy}, τ_{yx}.

2. Pressure distribution. If $p = p_0 (x = y = 0)$, and ignore the external force.