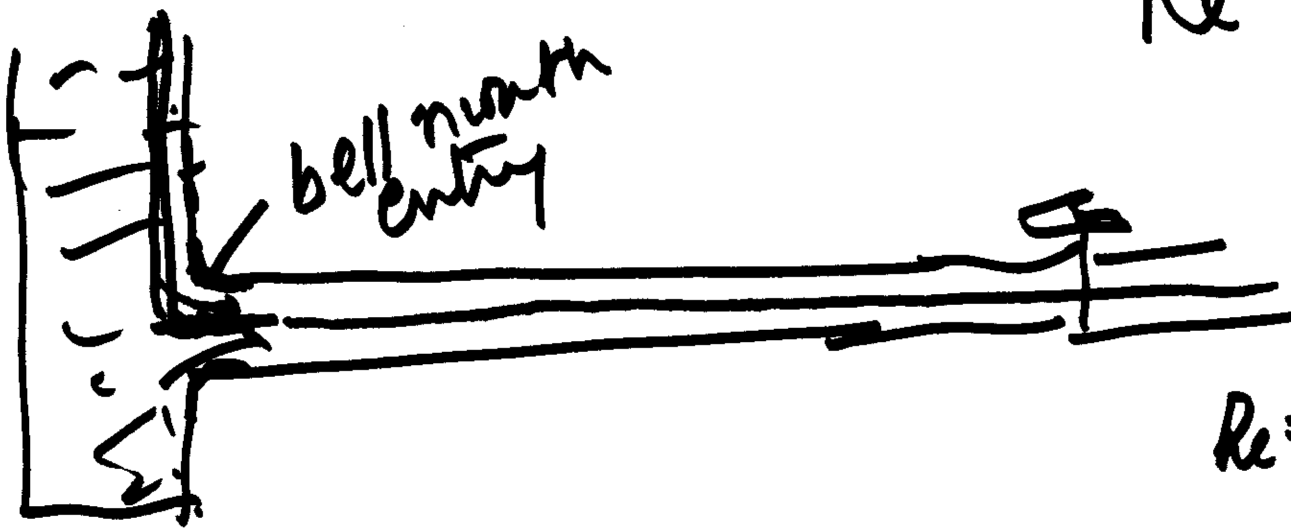
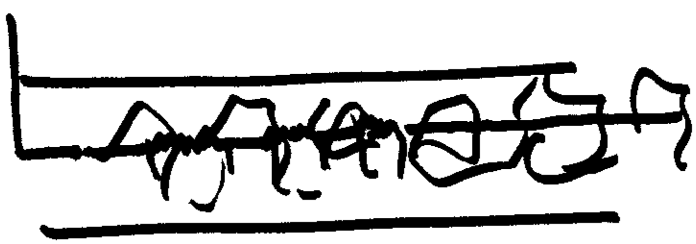
.A.W. Date
No. 21
: 11/2/11

$$Re = \frac{\rho V L}{\mu}$$



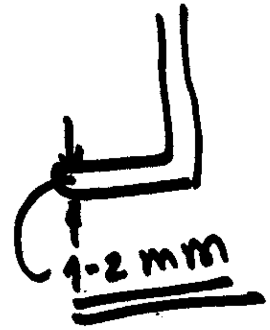


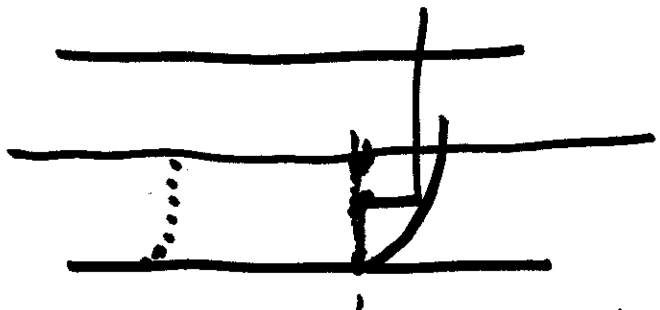
$$Re = \frac{\rho \bar{V} D}{\mu}$$

< 2000 (Laminar)

≃ 2500 } Transition Regime

> 3000 → Turbulent flow.



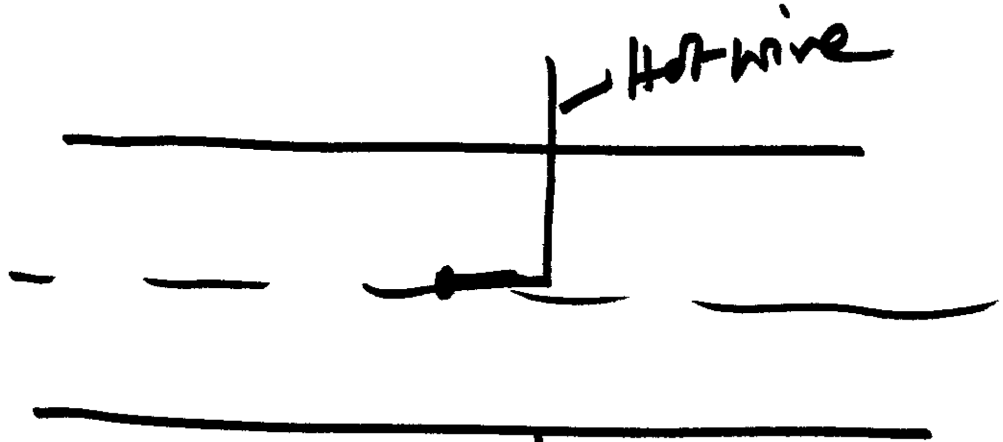


Hot wire Anemomenter

3 to 5 microns.

3×10^{-6} m

3×10^{-3} mm



$\hat{u}$

$$\frac{1}{t}\int_0^t \hat{u}\, dt = \overline{u}$$

$\rho_m = \text{Const}$

$$\frac{\partial \hat{u}_j}{\partial x_j} = 0 \qquad \frac{\partial}{\partial x_j}\left[\overline{u_j + u'_j}\right] = \frac{\partial u_j}{\partial x_j} + \frac{\partial \overline{u'_j}}{\partial x_j}^{\,0}$$

$u' \quad T'$

$$\overline{\hat{u}\hat{T}} = \overline{(u+u')\times(T+T')}$$

$$= (UT + \overline{u'T} + \overline{Tu'} + \overline{u'T'})$$

$$= (UT + \overline{u'}T + \overline{T}u' + \overline{u'T'})$$

$$= (UT + T \times \overline{u'}_{0} + u \times \overline{T'}_{=0} + \underline{\overline{u'T'}})$$

$$= (UT + \overline{u'T'}$$

$$= uT + \overline{u'T'}$$

u'

T'

$$\overline{\hat{\tau}_{ij}} = \mu\overline{\left(\frac{\partial \hat{u}_j}{\partial x_i} + \frac{\partial \hat{u}_i}{\partial x_j}\right)} =$$

$$= \mu\left[\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}\right]$$

$$\mu \hat{\Phi}_v = \mu \left[2\left(\frac{\partial \hat{u}_1}{\partial x_1}\right)^2 + \left(\frac{\partial \hat{u}_2}{\partial x_2}\right)^2 + \cdots \right.$$

$$\left. + \left(\frac{\partial \hat{u}_1}{\partial x_2} + \frac{\partial \hat{u}_2}{\partial x_1}\right)^2 + \cdots \right]$$

$$\overline{\left(\frac{\partial \hat{u}_1}{\partial x_1}\right)^2} = \overline{\left(\frac{\partial u_1}{\partial x_1} + \frac{\partial u_1'}{\partial x_1}\right)^2}$$

$$= \left(\frac{\partial u_1}{\partial x_1}\right)^2 + \overline{\left(\frac{\partial u_1'}{\partial x_1}\right)^2} + 2\,\overline{\frac{\partial u_1}{\partial x_1} * \frac{\partial u_1'}{\partial x_1}}$$

$$= \left(\frac{\partial u_1}{\partial x_1}\right)^2 + \overline{\left(\frac{\partial u_1'}{\partial x_1}\right)^2}$$