م/ محمد شعيتع

سكشن هيدروليكا

DATE / / OBJECT

prato type النموذج الطبيعي

model النموذج المعمل

⇐ بنشتغل بـ Scale L_R لكل الأبعاد

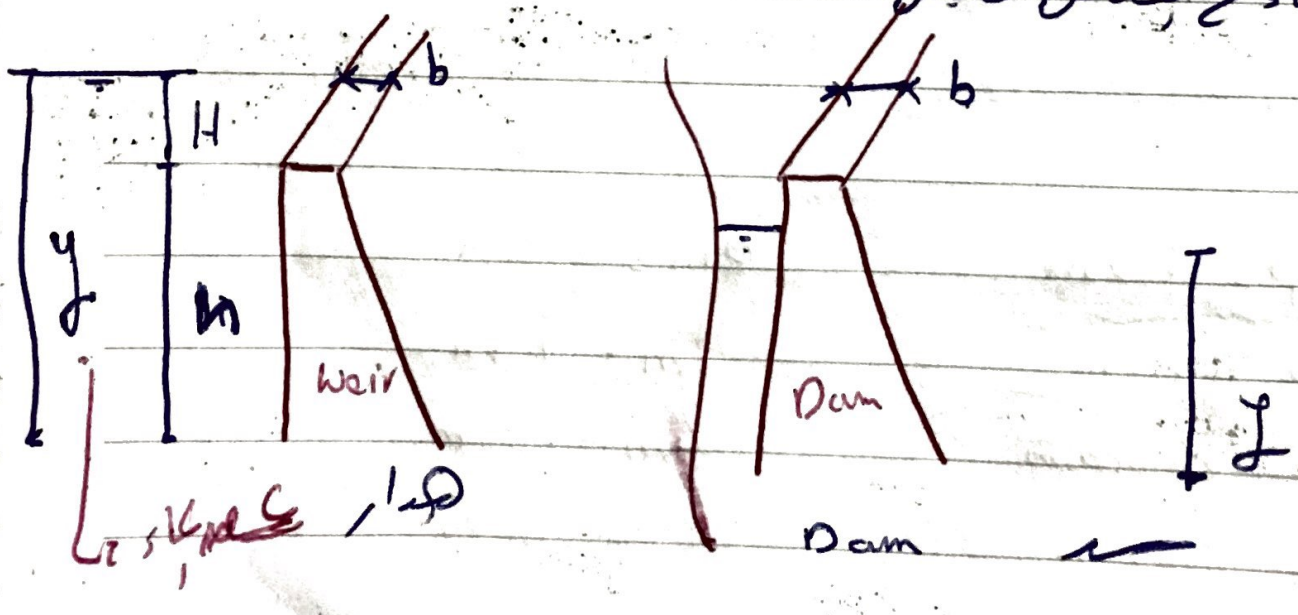
ومن حالة عدم توافق

⇐ بنشتغل بـ L_H & L_V

L_H للأبعاد الأفقية L_V للأبعاد الرأسية

شرط :-

~~model of~~ عمق الماء في المعمل لا يقل عن 15cm



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prototype Data $b_p = 300\ m$

$y_p = 10\ m$

length of backwater depth $L_p = 60000\ m$

$Q_p = 1000\ m^3/sec$

available lab Data $L_m = 30\ m$ Flown length

Flown width $b_m = 1,5\ m$

Flown depth $y_m = 1\ m$

pump discharg $Q_m = 0,5\ m^3/sec$

$b_p = 300\ m$ $b_m = 1,5\ m$

$y_p = 10\ m$ $y_m = 1\ m$

$L_p = 60000\ m$ $L_m = 30\ m$

$Q_p = 1000\ m^3/sec$ $Q_m = 0,5\ m^3/sec$

[1] assume undistored

$$* \ L_R = \frac{b_m}{b_p} = \frac{L_m}{L_p} = \frac{y_m}{y_p}$$

$L_{r_1} \leq L_{r_2} \leq L_{r_2}$ * بنحسبهم ونأخذ الأصغر

$$A_r = \frac{A_m}{A_p} = \frac{L_m\ b_m}{L_p\ b_p} = L_r^2$$

$$\forall_r = L_r^3 = \frac{\forall_m}{\forall_p}$$

$$V_r = \frac{V_m}{V_p} = L_r^{0,5}$$

$$T_r = \frac{T_m}{T_p} = L_r^{0,5}$$

$$Q_r = \frac{Q_m}{Q_p} = A_r \cdot V_r = L_r^2 \cdot L_r^{0,5} = L_r^{2,5}$$

[1] assum undstorted :-

$$l_{r_1} = \frac{b_m}{b_p} = \frac{1,5}{300} = \frac{1}{200}$$

$$l_{r_2} = \frac{y_m}{y_p} = \frac{\cancel{10}\,1}{10} =$$

$$l_{r_3} = \frac{L_m}{L_p} = \frac{30}{60000} = \frac{1}{2000}$$

$$Q_r = \frac{Q_m}{Q_p} = \frac{0,5}{1000} = l_{r_4}^{2,5}$$

$$l_{r_4} = \frac{1}{20,9}$$

بناخد أصغر Scale فيهم

take $l_r = \frac{1}{2000}$

$$l_r = \frac{1}{2000} = \frac{y_m}{y_p} \qquad \frac{1}{2000} = \frac{??}{10}$$

$$y_m = 0,5\ cm < 15\ cm$$

شرط

∴ un Scale

then assume Distorted Model:-

القوانين:-

$$L_{H_1} = \frac{b_m}{b_p} = \frac{1}{200}$$ من قبل كدا

$$L_{H_2} = \frac{L_m}{L_p} = \frac{1}{2000}$$ من قبل كدا بوضوح

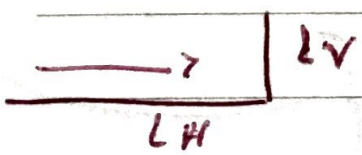
$$L_{V_1} = \frac{y_m}{y_p} = \frac{1}{10}$$

سرعة × مساحة

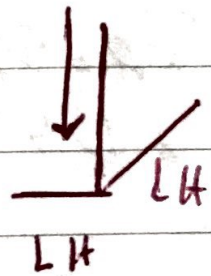
$$Q_r = \frac{Q_m}{Q_p} = A_r \cdot V_r =$$

نتوقف على اتجاه حركة السائل

$$V_r = L_r^{0,5}$$



$$= L_H \times L_v \times L_v^{0,5} = L_H \times L_v^{1,5}$$



$$\frac{0,5}{1000} = L_H \times L_v^{1,5}$$

← فيه حلين:- ① نثبت L_v ونعوض بالصغير من L_H ونوجد L_{v_2}

← نشوف مين الصغير وناخده نشتغل بيك

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وصول

② نثبت L_H ونعوض عن L_v ب L_v ونوجد L_{H_3}

← ونأخذ الصغير منهم ونشتغل بيه

الحل الثاني

$$\frac{0,5}{1000} = L_{H_3} \times \left(\frac{1}{10}\right)^{1,5} \qquad L_{H_3} = \frac{1}{63,24}$$

$$\therefore \text{take } L_H = \frac{1}{2000} \quad \& \quad L_v = \frac{1}{10}$$

③ Check

$$R_n = \frac{V \times R}{V}$$

(K.V) ← V

$$R_p = \frac{V_p \times R_p}{V_p}$$

ثابتة للمعمل والطبيعة ← V_p

$V_p = V_m$
$= 1 \times 10^{-6}\ m^2/sec$

$$V_p = \frac{Q_p}{A_p} = \frac{1000}{10 \times 300} = 0,33$$

$$R = \frac{A_p}{P_p} = \frac{300 \times 10}{(300 + 2 \times 10)} = 9,38\,m$$

دائماً قطاع مستطيل

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$$R_{np} = \frac{0,33 \times 9,38}{1 \times 10^{-6}} = 3,125 \times 10^{6} > 2000$$ 10

∴ Turbulent flow

$$\underline{R_{n_m}} = \frac{V_m \times R_m}{\nu_m}$$

$L_H = 1/2000$ هو احنا وصلنا ل Scale

$L_V = 1/10$

$$L_H = \frac{1}{2000} = \frac{b_m}{b_p} = \frac{b_m}{300} = \frac{y_m}{y_p} = \frac{y_m}{10}$$

$b_m = 0,15\,m = 15\,Cm$

$y_m = 1\,m$

$$Q_r = \frac{Q_m}{Q_p} = L_H \times L_V^{1,5}$$

$$?? \frac{Q_m}{1000} = \left(\frac{1}{2000}\right)\left(1/10\right)^{1,5}$$

$$Q_m = 0,0158\ m^3/Sec$$

$V_m = \frac{Q_m}{A_m} = \checkmark$

$R = \frac{A}{P} = \checkmark$

$\nu = 1 \times 10^{-6}$ /

$R_n = \_\_\_\_\_ = \checkmark$ > 2000

$\therefore$ turbulent

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② ممكن ~~[illegible]~~ يعطيك الأبعاد الطبيعية

Sache + ~~[illegible]~~

ويطلب أبعاد الـ Prototype

given :—

$L_H = 1/1000$

$L_V = \frac{1}{50}$

$b_p = 500\,m$

$y_p = 15\,m$

$Q_p = 300\,m^3/sec$

$L_p = 20000\,m$

Calculate the Lab Rey dimension

$$L_H = \frac{1}{1000} = \frac{b_m}{500} = \frac{L_m}{20000}$$

$L_m = \checkmark$

$b_m = \checkmark$

$$L_v = \frac{y_m}{y} = \frac{y_m}{15} = \frac{1}{50}$$

$y_m = \checkmark$

$$Q_r = \frac{Q_m}{300} \overset{?}{=} \underset{\checkmark}{L_H}\,\underset{\checkmark}{L_v}^{1,5}$$

$Q_m = \checkmark$

$Rn_m = \checkmark$

$Rn_p = \checkmark$

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③ ممكن الأبعاد الطبيعية معطاه فقط

① assume $L_H = \frac{1}{200} = \frac{b_m}{b_p} = \frac{L_m}{L_p}$

$b_m = \checkmark$

$L_m = \checkmark$

الأكبر من

$$L_v = 7 \begin{cases} \rightarrow 10 \times L_H = 1/20 \\ \rightarrow \frac{y_m}{y_p} = \frac{15}{1500} = \frac{1}{100} \end{cases}$$

فرضاً

take $L_v = 1/20 = \frac{y_m}{y_p} = \frac{y_m}{1500}$

$y_m = 75\,cm$