

Rumus Umum PPTB :

$$\frac{dh}{ds} = i \left\{ \frac{A^3 - \frac{\alpha Q^2 P}{g}}{A^3 - \frac{\alpha Q^2 B}{g}} \right\} = i \frac{F_{I \neq 0}}{F_{I = 0}}$$

A. Profil lingkaran : $\phi = \arccos \left(1 - \frac{h}{r} \right)$
 $P = 2\phi r$
 $B = 2r \sin \phi$
 $A = r^2 \left(\phi - \frac{1}{2} \sin 2\phi \right)$

$$\frac{d\phi}{dh} = \frac{-\frac{1}{r}}{\sqrt{1 - \left(1 - \frac{h}{r}\right)^2}} = \frac{1}{r \sqrt{1 - \cos^2 \phi}} = \frac{1}{r \sin \phi}$$

$$\frac{dP}{dh} = 2r \frac{d\phi}{dh} = \frac{2}{\sin \phi}$$

$$\frac{dB}{dh} = 2r \cos \phi \frac{d\phi}{dh} = \frac{2}{\tan \phi}$$

B. Profil $\neq 0$: $B = D + 2mh$
 $P = D + 2h \sqrt{1+m^2}$
 $A = (D + mh)h$

$$\frac{dP}{dh} = 2\sqrt{1+m^2}$$

$$\frac{dB}{dh} = 2m$$

I. Mencari h_{kr}

Syarat : $A^3 - \frac{\alpha Q^2}{g} B = 0$

$$F = A^3 - \frac{\alpha Q^2}{g} B \quad \text{dan} \quad F' = 3A^2 \frac{dA}{dh} - \frac{\alpha Q^2}{g} \frac{dB}{dh}$$

$$h_{kr} \text{ dicari dg } h_{n+1} = h_n - \frac{F(h_n)}{F'(h_n)}$$

"Starting point" $h_1 \rightarrow 0$: $h_1 = \left(\frac{\alpha Q^2}{g 2r^2} \right)^{1/3} \rightarrow h_1 = \left(\frac{\alpha Q^2}{g r^2} \right)^{1/3}$
 $\neq 0$: $h_1 = \left(\frac{\alpha Q^2}{g D^2} \right)^{1/3}$

II. Mencari H (Chezy)

Syarat : $A^3 - \frac{SQ^2}{i} P = 0$

$G = A^3 - \frac{SQ^2}{i} P$ dan $G' = 3A^2B - \frac{SQ^2}{i} \frac{dP}{dh}$

H dicari dg $H_{n+1} = H_n - \frac{G(H_n)}{G'(H_n)}$

"Starting point" $\rightarrow \odot : H_1 = \left(\frac{SQ^2}{i2r^2}\right)^{1/3} \approx \left(\frac{SQ^2}{ir^2}\right)^{1/3}$

$\neq \odot : H_1 = \frac{SQ^2}{iD^2}$

III. Mencari H (Manning)

$\delta = \frac{1}{C^2} = \frac{1}{\left(\frac{1}{n} R^{1/6}\right)^2}$

$= \frac{n^2}{R^{1/3}} = \frac{n^2 P^{1/3}}{A^{1/3}} \rightarrow \delta^3 = \frac{n^6 P}{A}$

$3\delta^2 \frac{d\delta}{dh} = n^6 \left\{ \frac{\frac{dP}{dh} A - \frac{dA}{dh} P}{A^2} \right\}$

$\frac{d\delta}{dh} = \frac{n^6}{3} \left\{ \frac{\frac{dP}{dh} A - BP}{A^2} \right\} \frac{A^{2/3}}{n^4 P^{2/3}}$

$= \frac{n^2}{3} \left\{ \frac{dP}{dh} A - BP \right\} \cdot \frac{1}{A^{4/3} P^{2/3}}$

$G = A^3 - \frac{SQ^2}{i} P$ dan $G' = 3A^2B - \frac{SQ^2}{i} \frac{dP}{dh} - \frac{PQ^2}{i} \frac{d\delta}{dh}$

"Starting point" $\rightarrow \odot : H_1 = \left(\frac{n^2 Q^2}{i2r^2}\right)^{3/10} \approx \left(\frac{n^2 Q^2}{ir^2}\right)^{3/10}$

$\neq \odot : H_1 = \left(\frac{n^2 Q^2}{iD^2}\right)^{3/10}$

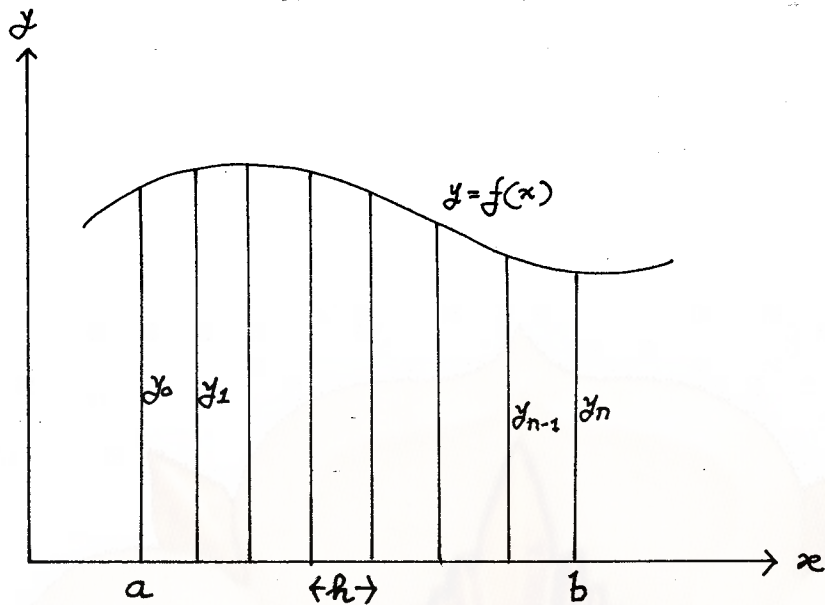
iv. Mencari dh

$dh = i \frac{G}{F} ds$!

v. Mencari ds

$ds = \frac{F}{Gi} dh$!

Simpson's Rule



$\int_a^b f(x) dx$ didekati dg \bar{A}_S dimana

$$\bar{A}_S = \frac{h}{3} (y_0 + 4y_1 + 2y_2 + 4y_3 + 2y_4 + \dots + 2y_{n-2} + 4y_{n-1} + y_n)$$

$$h = \frac{b-a}{n}, \text{ n genap}$$

Dirubah menjadi :

$$\begin{aligned} \bar{A}_S &= \frac{h}{3} \{ y_0 + 4(y_1 + y_3 + y_5 + \dots + y_{n-1}) + 2(y_2 + y_4 + \dots + y_{n-2} + y_n) \} \\ &= \frac{h}{3} \left\{ y_0 + \sum_{i=1}^{n/2} (4y_{2i-1} + 2y_{2i}) - y_n \right\} \end{aligned}$$

Rumus PPTB

$$ds = \frac{1 - \frac{\alpha Q^2 B}{g A^3}}{i - I} dh$$

Flat profile $I = \frac{\delta Q^2}{R A^2}$ dimana $\delta = \frac{1}{c^2}$.

Steep profile $\delta = \frac{1}{(\frac{1}{n} R^{1/6})^2} = \frac{n^2}{R^{1/3}} = \frac{n^2 P^{1/3}}{A^{1/3}} \rightarrow A^{1/3} \delta = n^2 P^{1/3}$

$$ds = \frac{1 - \frac{\alpha Q^2 B}{g A^3}}{i - \frac{\delta Q^2 P}{A^3}} dh = \frac{A^{1/3} - \frac{\alpha Q^2 B A^{1/3}}{g}}{i A^{1/3} - \delta Q^2 P A^{1/3}} dh$$

FP : $ds = \frac{A^{1/3} - \frac{\alpha Q^2 B}{g}}{i A^{1/3} - \frac{1}{c^2} Q^2 P} dh$

Steep : $ds = \frac{A^{1/3} - \frac{\alpha Q^2 B A^{1/3}}{g}}{i A^{1/3} - n^2 Q^2 P^{1/3}} dh$

- A Luas basah
- B Lebar m.a
- C Chezy / Manning Coeff.
- D Jari² \odot / Lebar basah saluran.
- E dP/dh saluran
- F Fungsi Newton
- G Turunan F } utk trial
- H h_{trial}
- I Idsr.
- J B, P utk trial * gsb 800
- K h_{kr}
- L i, g utk trial *
- M tglud saluran
- N $dP/dh, dB/dh$ utk trial *
- O α, S utk trial *
- P Kell basah.
- Q Debit
- R gravitasi
- S α
- T Counter jika $T=0$, gsb 800 $\rightarrow h_{kr}$, yg lainnya $H_n, R_{kr}^{2/3}$
- U dB/dh saluran.
- V H_{normal}
- W $\frac{dS}{dh}$ saluran
- X ϕ kontrol Chezy / Manning
- Y ϕ utk gsb 700
- Z Syarat H/B
- A0 $h_{bts 1}$
- A1 $h_{bts 2}$
- A2 E
- A3 $F(h_{ki})$
- A4 $F(h_{ko})$
- A5
- A6
- A7 Δ jumlah pias
- A8
- A9 Counter

