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Inlet Currents and Tidal Elevations Formulas

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List of 28 Inlet Currents and Tidal Elevations Formulas

Inlet Currents and Tidal Elevations

1) Average Area over Channel Length for Flow through Inlet into Bay

Open Calculator

fx $$A_{avg} = \frac{A_b \cdot d_{Bay}}{V_{avg}}$$

ex $$8.000533\text{m}^2 = \frac{1.5001\text{m}^2 \cdot 20}{3.75\text{m/s}}$$

2) Average Area over Channel Length using King's Dimensionless Velocity

Open Calculator

fx $$A_{avg} = \frac{V'_m \cdot 2 \cdot \pi \cdot a_o \cdot A_b}{T \cdot V_m}$$

ex $$7.780823\text{m}^2 = \frac{110 \cdot 2 \cdot \pi \cdot 4.0\text{m} \cdot 1.5001\text{m}^2}{130\text{s} \cdot 4.1\text{m/s}}$$

3) Average Velocity in Channel for Flow through Inlet into Bay

Open Calculator

fx $$V_{avg} = \frac{A_b \cdot d_{Bay}}{A_{avg}}$$

ex $$3.75025\text{m/s} = \frac{1.5001\text{m}^2 \cdot 20}{8\text{m}^2}$$

4) Bay Tide Amplitude given Tidal Prism Filling Bay

Open Calculator

fx $$a_B = \frac{P}{2 \cdot A_b}$$

ex $$10.66596 = \frac{32\text{m}^3}{2 \cdot 1.5001\text{m}^2}$$

5) Change of Bay Elevation with Time for Flow through Inlet into Bay

Open Calculator

fx $$d_{Bay} = \frac{A_{avg} \cdot V_{avg}}{A_b}$$

ex $$19.99867 = \frac{8\text{m}^2 \cdot 3.75\text{m/s}}{1.5001\text{m}^2}$$

6) Darcy - Weisbach Friction Term given Inlet Impedance

Open Calculator

fx $$f = \frac{4 \cdot r_H \cdot (Z - K_{en} - K_{ex})}{L}$$

ex $$0.02999 = \frac{4 \cdot 0.33\text{m} \cdot (2.246 - 1.01 - 0.1)}{50\text{m}}$$

7) Dimensionless Parameter Function of Hydraulic Radius and Manning's Roughness Coefficient

Open Calculator

fx $$f = \frac{116 \cdot n^2}{R_H^{\frac{1}{3}}}$$

ex $$0.029811 = \frac{116 \cdot (0.0198)^2}{(3.55\text{m})^{\frac{1}{3}}}$$

8) Duration of Inflow given Inlet Channel Velocity

Open Calculator

fx $$t = \frac{a\sin\left(\frac{c_1}{V_m}\right) \cdot T}{2 \cdot \pi}$$

ex $$0.007821\text{h} = \frac{a\sin\left(\frac{4.01\text{m/s}}{4.1\text{m/s}}\right) \cdot 130\text{s}}{2 \cdot \pi}$$

9) Entrance Energy Loss Coefficient given Inlet Impedance

Open Calculator

fx $$K_{en} = Z - K_{ex} - \left(f \cdot \frac{L}{4 \cdot r_H}\right)$$

ex $$1.009636 = 2.246 - 0.1 - \left(0.03 \cdot \frac{50\text{m}}{4 \cdot 0.33\text{m}}\right)$$

10) Exit Energy Loss Coefficient given Inlet Impedance

Open Calculator

fx $$K_{ex} = Z - K_{en} - \left(f \cdot \frac{L}{4 \cdot r_H} \right)$$

ex $$0.099636 = 2.246 - 1.01 - \left(0.03 \cdot \frac{50\text{m}}{4 \cdot 0.33\text{m}} \right)$$

11) Hydraulic Radius given Dimensionless Parameter

Open Calculator

fx $$R_H = \left(116 \cdot \frac{n^2}{f} \right)^3$$

ex $$3.483384\text{m} = \left(116 \cdot \frac{(0.0198)^2}{0.03} \right)^3$$

12) Inlet Channel Velocity

Open Calculator

fx $$c_1 = V_m \cdot \sin\left(2 \cdot \pi \cdot \frac{t}{T} \right)$$

ex $$4.070106\text{m/s} = 4.1\text{m/s} \cdot \sin\left(2 \cdot \pi \cdot \frac{1.2\text{h}}{130\text{s}} \right)$$

13) Inlet Friction Coefficient given Keulegan Repletion Coefficient

Open Calculator

fx $$K_1 = \frac{1}{(K \cdot K_2)^2}$$

ex $$28.44444 = \frac{1}{(0.75 \cdot 0.25)^2}$$

14) Inlet Friction Coefficient Parameter given Keulegan Repletion Coefficient

Open Calculator

fx $$K_2 = \frac{\sqrt{\frac{1}{K_1}}}{K}$$

ex $$0.248452 = \frac{\sqrt{\frac{1}{28.8}}}{0.75}$$

15) Inlet Hydraulic Radius given Inlet Impedance

Open Calculator

fx $$r_H = \frac{f \cdot L}{4 \cdot (Z - K_{ex} - K_{en})}$$

ex $$0.330106\text{m} = \frac{0.03 \cdot 50\text{m}}{4 \cdot (2.246 - 0.1 - 1.01)}$$

16) Inlet Impedance

Open Calculator

fx $$Z = K_{en} + K_{ex} + \left(f \cdot \frac{L}{4 \cdot r_H} \right)$$

ex $$2.246364 = 1.01 + 0.1 + \left(0.03 \cdot \frac{50\text{m}}{4 \cdot 0.33\text{m}} \right)$$

17) Inlet Length given Inlet Impedance

Open Calculator

fx $$L = 4 \cdot r_H \cdot \frac{Z - K_{ex} - K_{en}}{f}$$

ex $$49.984\text{m} = 4 \cdot 0.33\text{m} \cdot \frac{2.246 - 0.1 - 1.01}{0.03}$$

18) Keulegan Repletion Coefficient

Open Calculator

fx $$K = \frac{1}{K_2} \cdot \sqrt{\frac{1}{K_1}}$$

ex $$0.745356 = \frac{1}{0.25} \cdot \sqrt{\frac{1}{28.8}}$$

19) King's Dimensionless Velocity

Open Calculator

fx $$V'_m = \frac{A_{avg} \cdot T \cdot V_m}{2 \cdot \pi \cdot a_o \cdot A_b}$$

ex $$113.0986 = \frac{8\text{m}^2 \cdot 130\text{s} \cdot 4.1\text{m/s}}{2 \cdot \pi \cdot 4.0\text{m} \cdot 1.5001\text{m}^2}$$

20) Manning's Roughness Coefficient using Dimensionless Parameter

Open Calculator

fx $$n = \sqrt{f \cdot \frac{R_H^{\frac{1}{3}}}{116}}$$

ex $$0.019863 = \sqrt{0.03 \cdot \frac{(3.55\text{m})^{\frac{1}{3}}}{116}}$$

21) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle

Open Calculator

fx $$V_m = \frac{V'_m \cdot 2 \cdot \pi \cdot a_o \cdot A_b}{A_{avg} \cdot T}$$

ex $$3.987672\text{m/s} = \frac{110 \cdot 2 \cdot \pi \cdot 4.0\text{m} \cdot 1.5001\text{m}^2}{8\text{m}^2 \cdot 130\text{s}}$$

22) Maximum Cross-Sectionally Averaged Velocity during Tidal Cycle given Inlet Channel Velocity

Open Calculator

fx $$V_m = \frac{c_1}{\sin\left(2 \cdot \pi \cdot \frac{t}{T}\right)}$$

ex $$4.039452\text{m/s} = \frac{4.01\text{m/s}}{\sin\left(2 \cdot \pi \cdot \frac{1.2\text{h}}{130\text{s}}\right)}$$

23) Ocean Tide Amplitude using King's Dimensionless Velocity

Open Calculator

$$a_o = \frac{A_{avg} \cdot V_m \cdot T}{V'_m \cdot 2 \cdot \pi \cdot A_b}$$

$$4.112675\text{m} = \frac{8\text{m}^2 \cdot 4.1\text{m/s} \cdot 130\text{s}}{110 \cdot 2 \cdot \pi \cdot 1.5001\text{m}^2}$$

24) Surface Area of Bay for Flow through Inlet into Bay

Open Calculator

$$A_b = \frac{V_{avg} \cdot A_{avg}}{d_{Bay}}$$

$$1.5\text{m}^2 = \frac{3.75\text{m/s} \cdot 8\text{m}^2}{20}$$

25) Surface Area of Bay given Tidal Prism Filling Bay

Open Calculator

$$A_b = \frac{P}{2 \cdot a_B}$$

$$4.324324\text{m}^2 = \frac{32\text{m}^3}{2 \cdot 3.7}$$

26) Surface Area of Bay using King's Dimensionless Velocity

Open Calculator

$$A_b = \frac{A_{avg} \cdot T \cdot V_m}{V'_m \cdot 2 \cdot \pi \cdot a_o}$$

$$1.542356\text{m}^2 = \frac{8\text{m}^2 \cdot 130\text{s} \cdot 4.1\text{m/s}}{110 \cdot 2 \cdot \pi \cdot 4.0\text{m}}$$

27) Tidal Period using King's Dimensionless Velocity

Open Calculator

$$T = \frac{2 \cdot \pi \cdot a_o \cdot A_b \cdot V'_m}{A_{avg} \cdot V_m}$$

$$126.4384\text{s} = \frac{2 \cdot \pi \cdot 4.0\text{m} \cdot 1.5001\text{m}^2 \cdot 110}{8\text{m}^2 \cdot 4.1\text{m/s}}$$

28) Tidal Prism Filling Bay

Open Calculator

$$P = 2 \cdot a_B \cdot A_b$$

$$11.10074\text{m}^3 = 2 \cdot 3.7 \cdot 1.5001\text{m}^2$$

Variables Used

- A_{avg} Average Area over the Channel Length *(Square Meter)*
- a_B Bay Tide Amplitude
- A_b Surface Area of Bay *(Square Meter)*
- a_o Ocean Tide Amplitude *(Meter)*
- c_1 Inlet Velocity *(Meter per Second)*
- d_{Bay} Change of Bay Elevation with Time
- **f** Dimensionless Parameter
- **K** Keulegan Repletion Coefficient [dimensionless]
- K_1 King's Inlet Friction Coefficient
- K_2 King's 1st Inlet Friction Coefficient
- K_{en} Entrance Energy Loss Coefficient
- K_{ex} Exit Energy Loss Coefficient
- **L** Inlet Length *(Meter)*
- **n** Manning's Roughness Coefficient
- **P** Tidal Prism Filling Bay *(Cubic Meter)*
- r_H Hydraulic Radius *(Meter)*
- R_H Hydraulic Radius of the Channel *(Meter)*
- **t** Duration of Inflow *(Hour)*
- **T** Tidal Period *(Second)*
- V_{avg} Average Velocity in Channel for Flow *(Meter per Second)*
- V_m Maximum Cross Sectional Average Velocity *(Meter per Second)*

- V'_m King's Dimensionless Velocity
- Z Inlet Impedance

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s), Hour (h)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion

Check other formula lists

- **Bay Superelevation, Effect of Freshwater Inflow, Multiple Inlets and Wave-Current Interaction Formulas**
- **Inlet Currents and Tidal Elevations Formulas**

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