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Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas

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List of 27 Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas

Area-Velocity and Ultrasonic Method of Streamflow Measurement

Area-Velocity Method

1) Flow Velocity

Open Calculator

fx $V_f = V \cdot \sin(\theta)$

ex $7.660444\text{m/s} = 10\text{m/s} \cdot \sin(50^\circ)$

2) Moving Boat Velocity

Open Calculator

fx $v_b = V \cdot \cos(\theta)$

ex $6.427876\text{m/s} = 10\text{m/s} \cdot \cos(50^\circ)$

3) Moving Boat Velocity given Width between Two Verticals

Open Calculator

fx $v_b = \frac{W}{\Delta t}$

ex $6.382979\text{m/s} = \frac{300\text{m}}{47\text{s}}$

4) Partial Discharge in Sub-Area between Two Verticals given Flow Velocity

Open Calculator

fx $$\Delta Q_i = \left(\frac{y_i + y_{i+1}}{2}\right) \cdot W + 1 \cdot V_f$$

ex $$1057.6\text{m}^3/\text{s} = \left(\frac{3\text{m} + 4\text{m}}{2}\right) \cdot 300\text{m} + 1 \cdot 7.6\text{m/s}$$

5) Partial Discharge in Sub-Area between Two Verticals given Resultant Velocity

Open Calculator

fx $$\Delta Q_i = \left(\frac{y_i + y_{i+1}}{2}\right) \cdot V^2 \cdot \sin(\theta) \cdot \cos(\theta) \cdot \Delta t$$

ex $$135.0007\text{m}^3/\text{s} = \left(\frac{3\text{m} + 4\text{m}}{2}\right) \cdot (10\text{m/s})^2 \cdot \sin(50^\circ) \cdot \cos(50^\circ) \cdot 47\text{s}$$

6) Resultant Velocity given Flow Velocity

Open Calculator

fx $$V = \frac{V_f}{\sin(\theta)}$$

ex $$9.921095\text{m/s} = \frac{7.6\text{m/s}}{\sin(50^\circ)}$$

7) Resultant Velocity given Moving Boat Velocity

Open Calculator

fx $$V = \frac{v_b}{\cos(\theta)}$$

ex $$9.987747\text{m/s} = \frac{6.42\text{m/s}}{\cos(50^\circ)}$$

8) Time of Transit between two Verticals given Width between Verticals

Open Calculator

fx $$\Delta t = \frac{W}{v_b}$$

ex $$46.72897\text{s} = \frac{300\text{m}}{6.42\text{m/s}}$$

9) Width between Two Verticals

Open Calculator

fx $$W = v_b \cdot \Delta t$$

ex $$5.029\text{m} = 6.42\text{m/s} \cdot 47\text{s}$$

Measurement of Velocity

10) Average Stream Velocity given Minimum Weight

Open Calculator

fx $$v = \frac{N}{50 \cdot d}$$

ex $$20\text{m/s} = \frac{3300\text{N}}{50 \cdot 3.3\text{m}}$$

11) Average Velocity in Moderately Deep Streams

Open Calculator

$$v = \frac{v_{0.2} + v_{0.8}}{2}$$

$$20\text{m/s} = \frac{26\text{m/s} + 14\text{m/s}}{2}$$

12) Average Velocity obtained by using Reduction Factor

Open Calculator

$$v = K \cdot v_s$$

$$20.9\text{m/s} = 0.95 \cdot 22\text{m/s}$$

13) Depth of Flow at Vertical given Sounding Weights

Open Calculator

$$d = \frac{N}{50 \cdot v}$$

$$3.3\text{m} = \frac{3300\text{N}}{50 \cdot 20\text{m/s}}$$

14) Distance Travelled given Surface Velocity

Open Calculator

$$S = v_s \cdot t$$

$$110\text{m} = 22\text{m/s} \cdot 5\text{s}$$

15) Revolutions per Second of Horizontal Axis Meter given Stream Velocity

Open Calculator

fx $$\mathrm{Ns} = \frac{\mathrm{v} - \mathrm{b}}{\mathrm{a}}$$

ex $$32 = \frac{20\mathrm{m/s} - 0.8}{0.6}$$

16) Sounding Weights

Open Calculator

fx $$\mathrm{N} = 50 \cdot \mathrm{v} \cdot \mathrm{d}$$

ex $$3300\mathrm{N} = 50 \cdot 20\mathrm{m/s} \cdot 3.3\mathrm{m}$$

17) Stream Velocity at Instrument Location

Open Calculator

fx $$\mathrm{v} = \mathrm{a} \cdot \mathrm{Ns} + \mathrm{b}$$

ex $$20.6\mathrm{m/s} = 0.6 \cdot 33 + 0.8$$

18) Surface Velocity

Open Calculator

fx $$\mathrm{v_s} = \frac{\mathrm{S}}{\mathrm{t}}$$

ex $$22\mathrm{m/s} = \frac{110\mathrm{m}}{5\mathrm{s}}$$

19) Surface Velocity given Average of Velocity

Open Calculator

fx $$v_s = \frac{v}{K}$$

ex $$21.05263\text{m/s} = \frac{20\text{m/s}}{0.95}$$

20) Time of Distance Travelled given Surface Velocity

Open Calculator

fx $$t = \frac{S}{v_s}$$

ex $$5\text{s} = \frac{110\text{m}}{22\text{m/s}}$$

21) Velocity Distribution in Rough Turbulent Flow

Open Calculator

fx $$v = 5.75 \cdot v_{shear} \cdot \log 10\left(30 \cdot \frac{y}{k_s}\right)$$

ex $$20.77107\text{m/s} = 5.75 \cdot 6\text{m/s} \cdot \log 10\left(30 \cdot \frac{2\text{m}}{15}\right)$$

Ultrasonic Method

22) Average Velocity along Path AB at certain Height above Bed

Open Calculator

fx
$$v_{avg} = \left(\left(\frac{L}{2}\right) \cdot \cos(\theta)\right) \cdot \left(\left(\frac{1}{t_1}\right) - \left(\frac{1}{t_2}\right)\right)$$

ex
$$2.351318\text{m/s} = \left(\left(\frac{3000\text{m}}{2}\right) \cdot \cos(50^\circ)\right) \cdot \left(\left(\frac{1}{2.02\text{s}}\right) - \left(\frac{1}{2.03\text{s}}\right)\right)$$

23) Elapse Time of Ultrasonic Signal sent by A

Open Calculator

fx
$$t_1 = \frac{L}{C + v_p}$$

ex
$$2.020188\text{s} = \frac{3000\text{m}}{1480\text{m/s} + 5.01\text{m/s}}$$

24) Elapse Time of Ultrasonic Signal sent by B

Open Calculator

fx
$$t_2 = \frac{L}{C - v_p}$$

ex
$$2.033912\text{s} = \frac{3000\text{m}}{1480\text{m/s} - 5.01\text{m/s}}$$

25) Length of Path for Elapse Time of Ultrasonic Signal

Open Calculator

fx $$L = t_1 \cdot (C + v_p)$$

ex $$2999.72\text{m} = 2.02\text{s} \cdot (1480\text{m/s} + 5.01\text{m/s})$$

26) Length of Path given Elapse Time of Ultrasonic Signal

Open Calculator

fx $$L = t_1 \cdot (C - v_p)$$

ex $$2979.48\text{m} = 2.02\text{s} \cdot (1480\text{m/s} - 5.01\text{m/s})$$

27) Velocity of Sound in Water given Elapse Time of Ultrasonic Signal sent by A

Open Calculator

fx $$C = \left(\frac{L}{t_1}\right) - v_p$$

ex $$1480.139\text{m/s} = \left(\frac{3000\text{m}}{2.02\text{s}}\right) - 5.01\text{m/s}$$

Variables Used

- **a** Constant a
- **b** Constant b
- **C** Velocity of Sound in Water *(Meter per Second)*
- **d** Depth of Flow in Vertical *(Meter)*
- **K** Reduction Factor
- k_s Equivalent Sand-Grain Roughness
- **L** Length of Path from A to B *(Meter)*
- **N** Minimum Weight *(Newton)*
- **Ns** Revolutions per Second of Meter
- **S** Distance Travelled *(Meter)*
- **t** Time Taken to Travel *(Second)*
- t_1 Elapse Time t1 *(Second)*
- t_2 Elapse Time t2 *(Second)*
- **v** Average Velocity in Vertical *(Meter per Second)*
- **V** Resultant Velocity *(Meter per Second)*
- $v_{0.2}$ Velocity at 0.2 Times Depth of Flow *(Meter per Second)*
- $v_{0.8}$ Velocity at 0.8 Times Depth of Flow *(Meter per Second)*
- v_{avg} Average Velocity along Path *(Meter per Second)*
- v_b Boat Velocity *(Meter per Second)*
- V_f Flow Velocity *(Meter per Second)*
- v_p Component of Flow Velocity in Sound Path *(Meter per Second)*
- v_s Surface Velocity of River *(Meter per Second)*

- v_{shear} Shear Velocity *(Meter per Second)*
- W Width between Two Verticals *(Meter)*
- y Height above Bed *(Meter)*
- y_i Depth 'yi' of Flow in Sub-Area *(Meter)*
- y_{i+1} Depth 'i+1' of Flow in Sub-Area *(Meter)*
- ΔQ_i Partial Discharges *(Cubic Meter per Second)*
- Δt Time of Transit between Two Verticals *(Second)*
- θ Angle *(Degree)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion

Check other formula lists

- **Abstractions from Precipitation Formulas**
- **Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas**
- **Indirect Methods of Streamflow Measurement Formulas**
- **Losses from Precipitation Formulas**
- **Measurement of Evapotranspiration Formulas**
- **Precipitation Formulas**

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