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Important Formulas of Harbor Oscillation

Calculators! Examples! Conversions!

List of 11 Important Formulas of Harbor Oscillation

Important Formulas of Harbor Oscillation

1) Additional Length

Open Calculator

fx $$l'_c = \left([g] \cdot A_C \cdot \frac{\left(\frac{T_r 2}{2} \cdot \pi \right)^2}{A_s} \right) - L_{ch}$$

ex $$20.08745m = \left([g] \cdot 0.20m^2 \cdot \frac{\left(\frac{19.3s}{2} \cdot \pi \right)^2}{30m^2} \right) - 40.0m$$

2) Average Horizontal Velocity at Node

Open Calculator

fx $$V' = \frac{H_w \cdot \lambda}{\pi} \cdot d \cdot T_n$$

ex $$49.75747m/s = \frac{1.01m \cdot 26.8m}{\pi} \cdot 1.05m \cdot 5.50s$$

3) Basin Length along axis given Maximum Oscillation Period corresponding to Fundamental Mode

Open Calculator

fx $$L_{ba} = T_1 \cdot \frac{\sqrt{[g] \cdot D}}{2}$$

ex $$4.230733\text{m} = 0.013\text{min} \cdot \frac{\sqrt{[g] \cdot 12\text{m}}}{2}$$

4) Basin Length along Axis in Open Basin

Open Calculator

fx $$L_b = \frac{T_n \cdot (1 + (2 \cdot N)) \cdot \sqrt{[g] \cdot D_w}}{4}$$

ex $$159.1424\text{m} = \frac{5.50\text{s} \cdot (1 + (2 \cdot 1.3)) \cdot \sqrt{[g] \cdot 105.4\text{m}}}{4}$$

5) Maximum Horizontal Velocity at Node

Open Calculator

fx $$V_{max} = \left(\frac{H_w}{2}\right) \cdot \sqrt{\frac{[g]}{D_w}}$$

ex $$554.5413\text{m/h} = \left(\frac{1.01\text{m}}{2}\right) \cdot \sqrt{\frac{[g]}{105.4\text{m}}}$$

6) Natural Free Oscillation Period

fx Open Calculator

$$T_n = \left(\frac{2}{\sqrt{[g] \cdot d}}\right) \cdot \left(\left(\frac{n}{l_1}\right)^2 + \left(\frac{m}{l_2}\right)^2\right)^{-0.5}$$

ex

$$5.807563s = \left(\frac{2}{\sqrt{[g] \cdot 1.05m}}\right) \cdot \left(\left(\frac{3}{35.23m}\right)^2 + \left(\frac{2.0}{30.62m}\right)^2\right)^{-0.5}$$

7) Natural Free Oscillation Period for Closed Basin

fx Open Calculator

$$T_n = \frac{2 \cdot L_B}{N \cdot \sqrt{[g] \cdot D_w}}$$

ex

$$8.613477s = \frac{2 \cdot 180m}{1.3 \cdot \sqrt{[g] \cdot 105.4m}}$$

8) Natural Free Oscillation Period for Open Basin

fx Open Calculator

$$T_n = 4 \cdot \frac{L_B}{(1 + (2 \cdot N)) \cdot \sqrt{[g] \cdot D_w}}$$

ex

$$6.220845s = 4 \cdot \frac{180m}{(1 + (2 \cdot 1.3)) \cdot \sqrt{[g] \cdot 105.4m}}$$

9) Resonant Period for Helmholtz Mode

Open Calculator

fx $$T_H = (2 \cdot \pi) \cdot \sqrt{(L_{ch} + l'_c) \cdot \frac{A_b}{[g] \cdot A_C}}$$

ex $$42.56379\text{s} = (2 \cdot \pi) \cdot \sqrt{(40.0\text{m} + 20.0\text{m}) \cdot \frac{1.5001\text{m}^2}{[g] \cdot 0.20\text{m}^2}}$$

10) Standing Wave Height given Maximum Horizontal Velocity at Node

Open Calculator

fx $$H_w = \left(\frac{V_{max}}{\sqrt{\frac{[g]}{D_w}}} \right) \cdot 2$$

ex $$1.01\text{m} = \left(\frac{554.5413\text{m/h}}{\sqrt{\frac{[g]}{105.4\text{m}}}} \right) \cdot 2$$

11) Water Depth given Maximum Horizontal Velocity at Node

Open Calculator

fx $$D_w = \frac{[g]}{\left(\frac{V_{max}}{\frac{H_w}{2}} \right)^2}$$

ex $$105.4\text{m} = \frac{[g]}{\left(\frac{554.5413\text{m/h}}{\frac{1.01\text{m}}{2}} \right)^2}$$

Variables Used

- A_b Surface Area of Bay *(Square Meter)*
- A_C Cross Sectional Area *(Square Meter)*
- A_s Surface Area *(Square Meter)*
- d Water Depth at Harbor *(Meter)*
- D Water Depth *(Meter)*
- D_w Depth of Water *(Meter)*
- H_w Standing Wave Height of Ocean *(Meter)*
- l_1 Basin Dimensions along the X-axis *(Meter)*
- l_2 Basin Dimensions along the Y-axis *(Meter)*
- L_b Length of Open Basin along Axis *(Meter)*
- L_B Basin Length *(Meter)*
- L_{ba} Length of Basin along Axis *(Meter)*
- l'_c Additional Length of the Channel *(Meter)*
- L_{ch} Channel Length (Helmholtz Mode) *(Meter)*
- m Number of Nodes along the Y-axis of Basin
- n Number of Nodes along the X-axis of Basin
- N Number of Nodes along the Axis of a Basin
- T_1 Maximum Oscillation Period *(Minute)*
- T_H Resonant Period for Helmholtz Mode *(Second)*
- T_n Natural Free Oscillating Period of a Basin *(Second)*
- T_r2 Resonant Period *(Second)*

- **V'** Average Horizontal Velocity at a Node *(Meter per Second)*
- **V_{max}** Maximum Horizontal Velocity at a Node *(Meter per Hour)*
- **λ** Wavelength *(Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- 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), Minute (min)
  Time Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s), Meter per Hour (m/h)
  Speed Unit Conversion

Check other formula lists

- **Methods to Predict Channel Shoaling Formulas**
- **Nearshore Currents Formulas**
- **Wave Setup Formulas**

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