Important Formulas of Harbor Oscillation PDF

Formulas
Examples
with Units

List of 11
Important Formulas of Harbor Oscillation

1) Additional Length Formula

Evaluate Formula

Formula

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

Example with Units

$$20.0875\,\text{m} = \left(9.8066\,\text{m/s}^2 \cdot 0.20\,\text{m}^2 \cdot \frac{\left(\frac{19.3\,\text{s}}{2} \cdot 3.1416\right)^2}{30\,\text{m}^2} \right) - 40.0\,\text{m}$$

2) Average Horizontal Velocity at Node Formula

Evaluate Formula

Formula

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

Example with Units

$$49.7575\,\text{m/s} = \frac{1.01\,\text{m} \cdot 26.8\,\text{m}}{3.1416} \cdot 1.05\,\text{m} \cdot 5.50\,\text{s}$$

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

Evaluate Formula

Formula

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

Example with Units

$$4.2307\,\text{m} = 0.013\,\text{min} \cdot \frac{\sqrt{9.8066\,\text{m/s}^2 \cdot 12\,\text{m}}}{2}$$

4) Basin Length along Axis in Open Basin Formula

Evaluate Formula

Formula

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

Example with Units

$$159.1424\,\text{m} = \frac{5.50\,\text{s} \cdot (1 + (2 \cdot 1.3)) \cdot \sqrt{9.8066\,\text{m/s}^2 \cdot 105.4\,\text{m}}}{4}$$

5) Maximum Horizontal Velocity at Node Formula

Evaluate Formula

Formula

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

Example with Units

$$554.5413\,\text{m/h} = \left(\frac{1.01\,\text{m}}{2}\right) \cdot \sqrt{\frac{9.8066\,\text{m/s}^2}{105.4\,\text{m}}}$$

6) Natural Free Oscillation Period Formula

Evaluate Formula

Formula

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

Example with Units

$$5.8076\,\text{s} = \left(\frac{2}{\sqrt{9.8066\,\text{m/s}^2 \cdot 1.05\,\text{m}}}\right) \cdot \left(\left(\frac{3}{35.23\,\text{m}}\right)^2 + \left(\frac{2.0}{30.62\,\text{m}}\right)^2\right)^{-0.5}$$

7) Natural Free Oscillation Period for Closed Basin Formula

Evaluate Formula

Formula

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

Example with Units

$$8.6135\,\text{s} = \frac{2 \cdot 180\,\text{m}}{1.3 \cdot \sqrt{9.8066\,\text{m/s}^2 \cdot 105.4\,\text{m}}}$$

8) Natural Free Oscillation Period for Open Basin Formula

Evaluate Formula

Formula

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

Example with Units

$$6.2208\,\text{s} = 4 \cdot \frac{180\,\text{m}}{(1 + (2 \cdot 1.3)) \cdot \sqrt{9.8066\,\text{m/s}^2 \cdot 105.4\,\text{m}}}$$

9) Resonant Period for Helmholtz Mode Formula

Evaluate Formula

Formula

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

Example with Units

$$42.5638\,\text{s} = (2 \cdot 3.1416) \cdot \sqrt{(40.0\,\text{m} + 20.0\,\text{m}) \cdot \frac{1.5001\,\text{m}^2}{9.8066\,\text{m/s}^2 \cdot 0.20\,\text{m}^2}}$$

10) Standing Wave Height given Maximum Horizontal Velocity at Node Formula

Evaluate Formula

Formula

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

Example with Units

$$1.01\,\text{m} = \left(\frac{554.5413\,\text{m/h}}{\sqrt{\frac{9.8066\,\text{m/s}^2}{105.4\,\text{m}}}}\right) \cdot 2$$

11) Water Depth given Maximum Horizontal Velocity at Node Formula

Evaluate Formula

Formula

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

Example with Units

$$105.4\,\text{m} = \frac{9.8066\,\text{m/s}^2}{\left(\frac{554.5413\,\text{m/h}}{\frac{1.01\,\text{m}}{2}}\right)^2}$$

Variables used in list of Important Formulas of Harbor Oscillation above

- 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 in list of Important Formulas of Harbor Oscillation above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[g]**, 9.80665 *Gravitational acceleration on Earth*
- Functions: **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*

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