Important Wave Parameters Formulas PDF

Formulas
Examples
with Units

List of 18
Important Wave Parameters Formulas

1) Angular of Radian Frequency of Wave Formula

Evaluate Formula

Formula

$$\omega = 2 \cdot \frac{\pi}{P}$$

Example with Units

$$6.1002\,\text{rad/s} = 2 \cdot \frac{3.1416}{1.03}$$

2) Eckart's Equation for Wavelength Formula

Evaluate Formula

Formula

$$\lambda = \left(\left([g] \cdot \frac{P^2}{2} \cdot \pi \right) \cdot \sqrt{\frac{\tanh\left(4 \cdot \pi^2 \cdot d\right)}{P^2} \cdot [g]} \right)$$

Example with Units

$$49.6865\,\text{m} = \left(\left(9.8066\,\text{m/s}^2 \cdot \frac{1.03^2}{2} \cdot 3.1416 \right) \cdot \sqrt{\frac{\tanh\left(4 \cdot 3.1416^2 \cdot 0.91\,\text{m}\right)}{1.03^2} \cdot 9.8066\,\text{m/s}^2} \right)$$

3) Elevation of Water Surface Relative to SWL Formula

Evaluate Formula

Formula

$$\eta = a \cdot \cos(\theta)$$

Example with Units

$$1.351\,\text{m} = 1.56\,\text{m} \cdot \cos(30°)$$

4) Major Horizontal Semi-Axis given wavelength, Wave Height and Water Depth Formula

Evaluate Formula

Formula

$$A = \left(\frac{H}{2} \right) \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right)}{\sinh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)}$$

Example with Units

$$7.759 = \left(\frac{3\,\text{m}}{2} \right) \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right)}{\sinh\left(2 \cdot 3.1416 \cdot \frac{0.91\,\text{m}}{26.8\,\text{m}}\right)}$$

5) Maximum Wave Steepness for Waves Travelling Formula

Evaluate Formula

Formula

$$\varepsilon_s = 0.142 \cdot \tanh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)$$

Example with Units

$$0.0298 = 0.142 \cdot \tanh\left(2 \cdot 3.1416 \cdot \frac{0.91\,\text{m}}{26.8\,\text{m}}\right)$$

6) Minor Vertical Semi-Axis given Wavelength, Wave Height and Water Depth Formula

Evaluate Formula

Formula

$$B = \left(\frac{H}{2}\right) \cdot \frac{\sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right)}{\sinh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)}$$

Example with Units

$$3.393 = \left(\frac{3\,\text{m}}{2}\right) \cdot \frac{\sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right)}{\sinh\left(2 \cdot 3.1416 \cdot \frac{0.91\,\text{m}}{26.8\,\text{m}}\right)}$$

7) Phase Velocity or Wave Celerity Formula

Evaluate Formula

Formula

$$C = \frac{\lambda}{P}$$

Example with Units

$$26.0194\,\text{m/s} = \frac{26.8\,\text{m}}{1.03}$$

8) Phase Velocity or Wave Celerity given Radian Frequency and Wavenumber Formula

Evaluate Formula

Formula

$$C = \frac{\omega}{k}$$

Example with Units

$$26.9565\,\text{m/s} = \frac{6.2\,\text{rad/s}}{0.23}$$

9) Radian Frequency given Wave Celerity Formula

Evaluate Formula

Formula

$$\omega = C \cdot k$$

Example with Units

$$5.5315\,\text{rad/s} = 24.05\,\text{m/s} \cdot 0.23$$

10) Water Depth for Maximum Wave Steepness of Waves Travelling Formula

Evaluate Formula

Formula

$$d = \lambda \cdot a \frac{\tanh\left(\frac{\varepsilon_s}{0.142}\right)}{2 \cdot \pi}$$

Example with Units

$$0.9149\,\text{m} = 26.8\,\text{m} \cdot a \frac{\tanh\left(\frac{0.03}{0.142}\right)}{2 \cdot 3.1416}$$

11) Wave Amplitude Formula

Evaluate Formula

Formula

$$a = \frac{H}{2}$$

Example with Units

$$1.5\,\text{m} = \frac{3\,\text{m}}{2}$$

12) Wave Amplitude given Elevation of Water Surface Relative to SWL Formula

Evaluate Formula

Formula

$$a = \frac{\eta}{\cos(\theta)}$$

Example with Units

$$0.2078\,\text{m} = \frac{0.18\,\text{m}}{\cos(30°)}$$

13) Wave Height given Maximum Wave Steepness Limit by Michell Formula

Evaluate Formula

Formula

$$H = \lambda \cdot 0.142$$

Example with Units

$$3.8056\,\text{m} = 26.8\,\text{m} \cdot 0.142$$

14) Wave Number given Wave Celerity Formula

Evaluate Formula

Formula

$$k = \frac{\omega}{C}$$

Example with Units

$$0.2578 = \frac{6.2\,\text{rad/s}}{24.05\,\text{m/s}}$$

15) Wave number given wavelength Formula

Evaluate Formula

Formula

$$k = 2 \cdot \frac{\pi}{\lambda}$$

Example with Units

$$0.2344 = 2 \cdot \frac{3.1416}{26.8\,\text{m}}$$

16) Wave Steepness Formula

Evaluate Formula

Formula

$$\varepsilon_s = \frac{H}{\lambda}$$

Example with Units

$$0.1119 = \frac{3\,\text{m}}{26.8\,\text{m}}$$

17) Wavelength for Maximum Wave Steepness Formula

Evaluate Formula

Formula

$$\lambda = 2 \cdot \pi \cdot \frac{d}{a} \tanh\left(\frac{\varepsilon_s}{0.142}\right)$$

Example with Units

$$26.6562\,\text{m} = 2 \cdot 3.1416 \cdot \frac{0.91\,\text{m}}{a} \tanh\left(\frac{0.03}{0.142}\right)$$

18) Wavelength given Maximum Wave Steepness Limit by Michell Formula

Evaluate Formula

Formula

$$\lambda = \frac{H}{0.142}$$

Example with Units

$$21.1268\,\text{m} = \frac{3\,\text{m}}{0.142}$$

Variables used in list of Wave Parameters Formulas above

- **a** Wave Amplitude *(Meter)*
- **A** Horizontal Semi-axis of Water Particle
- **B** Vertical Semi-Axis
- **C** Celerity of the Wave *(Meter per Second)*
- **d** Water Depth *(Meter)*
- D_{Z+d} Distance above the Bottom *(Meter)*
- **H** Wave Height *(Meter)*
- **k** Wave Number
- **P** Wave Period
- ε_s Wave Steepness
- **η** Elevation of Water Surface *(Meter)*
- **θ** Theta *(Degree)*
- **λ** Wavelength *(Meter)*
- **ω** Wave Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Wave Parameters Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **atanh**, atanh(Number)
  The inverse hyperbolic tangent function returns the value whose hyperbolic tangent is a number.
- Functions: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Functions: **cosh**, cosh(Number)
  The hyperbolic cosine function is a mathematical function that is defined as the ratio of the sum of the exponential functions of x and negative x to 2.
- Functions: **sinh**, sinh(Number)
  The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.
- 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.
- Functions: **tanh**, tanh(Number)
  The hyperbolic tangent function (tanh) is a function that is defined as the ratio of the hyperbolic sine function (sinh) to the hyperbolic cosine function (cosh).
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

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