Important Wave Period Distribution and Wave Spectrum Formulas PDF

Formulas
Examples
with Units

List of 10
Important Wave Period Distribution and Wave Spectrum Formulas

1) Equilibrium Form of PM Spectrum for Fully-Developed Seas Formula

Evaluate Formula

Formula

$$E_f = \left(\frac{0.0081 \cdot [g]^2}{(2 \cdot \pi)^4 \cdot f^5}\right) \cdot \exp\left(-0.24 \cdot \left(\frac{2 \cdot \pi \cdot U \cdot f}{[g]}\right)^{-4}\right)$$

Example with Units

$$1.5E\text{-}8 = \left(\frac{0.0081 \cdot 9.8066\,\text{m/s}^2{}^2}{(2 \cdot 3.1416)^4 \cdot 8\,\text{kHz}^5}\right) \cdot \exp\left(-0.24 \cdot \left(\frac{2 \cdot 3.1416 \cdot 4\,\text{m/s} \cdot 8\,\text{kHz}}{9.8066\,\text{m/s}^2}\right)^{-4}\right)$$

2) Maximum Wave Period Formula

Evaluate Formula

Formula

$$T_{max} = \Delta \cdot T'$$

Example with Units

$$85.8\,\text{s} = 33 \cdot 2.6\,\text{s}$$

3) Mean Crest Period Formula

Evaluate Formula

Formula

$$T_c = 2 \cdot \pi \cdot \left(\frac{m_2}{m_4}\right)$$

Example with Units

$$14.9093\,\text{s} = 2 \cdot 3.1416 \cdot \left(\frac{1.4}{0.59}\right)$$

4) Mean Zero-upcrossing Period Formula

Evaluate Formula

Formula

$$T'_Z = 2 \cdot \pi \cdot \sqrt{\frac{m_0}{m_2}}$$

Example with Units

$$86.4448\,\text{s} = 2 \cdot 3.1416 \cdot \sqrt{\frac{265}{1.4}}$$

5) Most Probable Maximum Wave Period Formula

Evaluate Formula

Formula

$$T_{max} = 2 \cdot \frac{\sqrt{1 + v^2}}{1} + \sqrt{1 + \left(16 \cdot \frac{v^2}{\pi} \cdot H^2 \right)}$$

Example with Units

$$87.8099\,\text{s} = 2 \cdot \frac{\sqrt{1 + 10^2}}{1} + \sqrt{1 + \left(16 \cdot \frac{10^2}{3.1416} \cdot 3\,\text{m}^2 \right)}$$

6) Probability Density of Wave Period Formula

Evaluate Formula

Formula

$$p = 2.7 \cdot \left(\frac{P^3}{T'} \right) \cdot \exp\left(-0.675 \cdot \left(\frac{P}{T'} \right)^4 \right)$$

Example with Units

$$1.116 = 2.7 \cdot \left(\frac{1.03^3}{2.6\,\text{s}} \right) \cdot \exp\left(-0.675 \cdot \left(\frac{1.03}{2.6\,\text{s}} \right)^4 \right)$$

7) Relative Phase given coefficients Formula

Evaluate Formula

Formula

$$\varepsilon_v = a\tanh\left(\frac{b_n}{a_n} \right)$$

Example

$$0.1682 = a\tanh\left(\frac{0.1}{0.6} \right)$$

8) Spectral Bandwidth Formula

Evaluate Formula

Formula

$$V = \sqrt{1 - \left(\frac{m_2^2}{m_0 \cdot m_4} \right)}$$

Example with Units

$$0.9937\,\text{m} = \sqrt{1 - \left(\frac{1.4^2}{265 \cdot 0.59} \right)}$$

9) Spectral Width Formula

Evaluate Formula

Formula

$$v = \sqrt{\left(m_0 \cdot \frac{m_2}{m_1^2} \right) - 1}$$

Example

$$9.5786 = \sqrt{\left(265 \cdot \frac{1.4}{2^2} \right) - 1}$$

10) Wave Component Amplitude Formula

Evaluate Formula

Formula

$$a = \sqrt{0.5 \cdot \sqrt{a_n^2 + b_n^2}}$$

Example with Units

$$0.5515\,\text{m} = \sqrt{0.5 \cdot \sqrt{0.6^2 + 0.1^2}}$$

Variables used in list of Wave Period Distribution and Wave Spectrum Formulas above

- **a** Wave Amplitude *(Meter)*
- a_n Coefficient of Wave Component Amplitude
- b_n Coefficient of Wave Component Amplitude bn
- E_f Frequency Energy Spectrum
- **f** Wave Frequency *(Kilohertz)*
- **H** Wave Height *(Meter)*
- m_0 Zero-th Moment of Wave Spectrum
- m_1 Moment of Wave Spectrum 1
- m_2 Moment of Wave Spectrum 2
- m_4 Moment of Wave Spectrum 4
- **p** Probability
- **P** Wave Period
- **T'** Mean Wave Period *(Second)*
- T_c Wave Crest Period *(Second)*
- T_{max} Maximum Wave Period *(Second)*
- T'_Z Mean Zero-upcrossing Period *(Second)*
- **U** Wind Speed *(Meter per Second)*
- **v** Spectral Width
- **V** Spectral Bandwidth *(Meter)*
- **Δ** Coefficient Eckman
- ε_v Relative Phase

Constants, Functions, Measurements used in list of Wave Period Distribution and Wave Spectrum 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: **exp**, exp(Number) *n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.*
- 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: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Frequency** in Kilohertz (kHz) *Frequency Unit Conversion*

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