Important Return Period and Encounter Probability Formulas PDF

Formulas

Examples

with Units

List of 9
Important Return Period and Encounter Probability Formulas

1) Cumulative Probability of Design Significant Wave Height given Return Period Formula

Formula

$$PH_s = -\left(\left(\frac{t}{T_r}\right) - 1\right)$$

Example

$$0.4 = -\left(\left(\frac{30}{50}\right) - 1\right)$$

2) Encounter Probability Formula

Formula

$$P_e = 1 - \left(1 - \left(\frac{t}{T_r}\right)\right)^L$$

Example

$$0.9416 = 1 - \left(1 - \left(\frac{30}{50}\right)\right)^{3.1}$$

3) Mean Value of Maximum Monthly Wind Speeds for Wind Speed with r-year Return Period Formula

Formula

$$U_m = U_r - \left(0.78 \cdot \sigma_m \cdot \left(\ln\left(12 \cdot T_r\right) - 0.577\right)\right)$$

Example with Units

$$17.5287 \, m/s = 32.6 \, m/s - \left(0.78 \cdot 3.32 \cdot \left(\ln\left(12 \cdot 50\right) - 0.577\right)\right)$$

4) Return Period given Cumulative Probability Formula

Formula

$$T_r = \frac{t}{1 - PH_s}$$

Example

$$50 = \frac{30}{1 - 0.4}$$

5) Significant Wave Height for Free Long Waves Formula

Formula

$$H_{sf} = \frac{K \cdot H_s^{1.11} \cdot T_p^{1.25}}{D^{0.25}}$$

Example with Units

$$16.5777 \, m = \frac{0.0041 \cdot 65 \, m^{1.11} \cdot 31 \, s^{1.25}}{12 \, m^{0.25}}$$

6) Standard Deviation of Maximum Monthly Wind Speeds given Wind Speed with r-year Return Period Formula 📲

Evaluate Formula 📲

Formula

$$\sigma_m = \frac{U_r - U_m}{0.78 \cdot \left(\ln \left(12 \cdot T_r \right) - 0.577 \right)}$$

Example with Units

$$3.3263 = \frac{32.6 \, \text{m/s} - 17.50 \, \text{m/s}}{0.78 \cdot \left(\ln \left(12 \cdot 50 \right) - 0.577 \right)}$$

7) Time Interval Associated with Each Data Point given Return Period Formula 📲

Evaluate Formula 📲

Formula

$$t = T_r \cdot \left(1 - PH_s \right)$$

Example

$$30 = 50 \cdot \left(1 - 0.4 \right)$$

8) Velocity at Surface given Volume Flow Rate Per Unit of Ocean Width Formula 📲

Evaluate Formula 📲

Formula

$$V_s = \frac{q_x \cdot \pi \cdot \sqrt{2}}{D_F}$$

Example with Units

$$0.4998 \, \text{m/s} = \frac{13.5 \, \text{m}^3\text{/s} \cdot 3.1416 \cdot \sqrt{2}}{120 \, \text{m}}$$

9) Wind Speed with r-year Return Period Formula 📲

Evaluate Formula 📲

Formula

$$U_r = U_m + 0.78 \cdot \sigma_m \cdot \left(\ln \left(12 \cdot T_r \right) - 0.577 \right)$$

Example with Units

$$32.5713 \, \text{m/s} = 17.50 \, \text{m/s} + 0.78 \cdot 3.32 \cdot \left(\ln \left(12 \cdot 50 \right) - 0.577 \right)$$

Variables used in list of Return Period and Encounter Probability Formulas above

- **D** Water Depth *(Meter)*
- **D$_F$** Depth of Frictional Influence *(Meter)*
- **H$_s$** Significant Wave Height *(Meter)*
- **H$_{sf}$** Significant Wave Height for Free Waves *(Meter)*
- **K** Constant for Free Long Waves
- **L** Desired Time Period
- **P$_e$** Encounter Probability
- **PH$_s$** Cumulative Probability
- **q$_x$** Volume Flow Rates per unit of Ocean Width *(Cubic Meter per Second)*
- **t** Time Interval associated with each Data Point
- **T$_p$** Design Wave Period *(Second)*
- **T$_r$** Return Period of Wind
- **U$_m$** Mean Value of Maximum Monthly Wind Speeds *(Meter per Second)*
- **U$_r$** Wind Speed with r Year Return Period *(Meter per Second)*
- **V$_s$** Velocity at the Surface *(Meter per Second)*
- **σ$_m$** Standard Deviation of Maximum Monthly Wind Speeds

Constants, Functions, Measurements used in list of Return Period and Encounter Probability Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **ln**, ln(Number) *The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential 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.*
- 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: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s) *Volumetric Flow Rate Unit Conversion* ↪

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