Important Irregular Waves Formulas PDF

Formulas
Examples
with Units

List of 21
Important Irregular Waves Formulas

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1) Average of Highest One Tenth of Runups Formula

Formula

$$R_{1/10} = H_d \cdot 1.7 \cdot \varepsilon_0^{\,0.71}$$

Example with Units

$$59.5414\,\text{m} = 6.0\,\text{m} \cdot 1.7 \cdot 12^{0.71}$$

Evaluate Formula

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2) Average of Highest One Third of Runups Formula

Formula

$$R_{1/3} = H_d \cdot 1.38 \cdot \varepsilon_0^{\,0.7}$$

Example with Units

$$47.1473\,\text{m} = 6.0\,\text{m} \cdot 1.38 \cdot 12^{0.7}$$

Evaluate Formula

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3) Deepwater Surf Similarity Parameter Formula

Formula

$$\xi_o = \tan(\beta) \cdot \left(\frac{H_o}{L_o}\right)^{-0.5}$$

Example with Units

$$0.4082 = \tan(30°) \cdot \left(\frac{6\,\text{m}}{3.0\,\text{m}}\right)^{-0.5}$$

Evaluate Formula

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4) Deepwater Surf Similarity Parameter given Average of Highest One Tenth of Runups Formula

Formula

$$\varepsilon_0 = \left(\frac{R_{1/10}}{H_d \cdot 1.7}\right)^{\frac{1}{0.71}}$$

Example with Units

$$12.1304 = \left(\frac{60\,\text{m}}{6.0\,\text{m} \cdot 1.7}\right)^{\frac{1}{0.71}}$$

Evaluate Formula

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5) Deepwater Surf Similarity Parameter given Maximum Runup Formula

Formula

$$\varepsilon_0 = \left(\frac{R}{H_d} \cdot 2.32\right)^{\frac{1}{0.77}}$$

Example with Units

$$14.247 = \left(\frac{20\,\text{m}}{6.0\,\text{m}} \cdot 2.32\right)^{\frac{1}{0.77}}$$

Evaluate Formula

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6) Deepwater Surf Similarity Parameter given Mean Runup Formula 📲

Formula

$$\varepsilon_0 = \frac{\left(\frac{R'}{0.88 \cdot H_d}\right)^1}{0.69}$$

Example with Units

$$12.0224 = \frac{\left(\frac{43.80\,m}{0.88 \cdot 6.0\,m}\right)^1}{0.69}$$

7) Deepwater Surf Similarity Parameter given Runup Formula 📲

Formula

$$\varepsilon_0 = \left(\frac{R_{2\%}}{H_d \cdot 1.86}\right)^{\frac{1}{0.71}}$$

Example with Units

$$11.9623 = \left(\frac{65\,m}{6.0\,m \cdot 1.86}\right)^{\frac{1}{0.71}}$$

8) Deepwater Wave Height given Average of Highest One Tenth of Runups Formula 📲

Formula

$$H_d = \frac{R_{1/10}}{1.7 \cdot \varepsilon_0^{0.71}}$$

Example with Units

$$6.0462\,m = \frac{60\,m}{1.7 \cdot 12^{0.71}}$$

9) Deepwater Wave Height given Average of Highest One Third of Runups Formula 📲

Formula

$$H_d = \frac{R_{1/3}}{1.38 \cdot \varepsilon_0^{0.7}}$$

Example with Units

$$5.9812\,m = \frac{47\,m}{1.38 \cdot 12^{0.7}}$$

10) Deepwater Wave Height given Maximum Runup Formula 📲

Formula

$$H_{d'} = \frac{R}{2.32 \cdot \varepsilon_0^{0.77}}$$

Example with Units

$$1.2722\,m = \frac{20\,m}{2.32 \cdot 12^{0.77}}$$

11) Deepwater Wave Height given Mean Runup Formula 📲

Formula

$$H_d = \frac{R'}{0.88 \cdot \varepsilon_0^{0.69}}$$

Example with Units

$$8.961\,m = \frac{43.80\,m}{0.88 \cdot 12^{0.69}}$$

12) Deepwater Wave Height given Runup Exceeded by 2 Percent of Runup Crests Formula 📲

Formula

$$H_d = \frac{R_{2\%}}{1.86 \cdot \varepsilon_0^{0.71}}$$

Example with Units

$$5.9866\,m = \frac{65\,m}{1.86 \cdot 12^{0.71}}$$

13) Deepwater Wave Height given Surf Similarity Parameter Formula

Formula

$$H_o = L_o \cdot \left(\frac{\xi_o}{\tan(\beta)} \right)^{-\frac{1}{0.5}}$$

Example with Units

$$6.0073\,\text{m} = 3.0\,\text{m} \cdot \left(\frac{0.408}{\tan(30°)} \right)^{-\frac{1}{0.5}}$$

Evaluate Formula

14) Deepwater Wavelength given Surf Similarity Parameter Formula

Formula

$$L_o = \frac{H_o}{\left(\frac{\xi_o}{\tan(\beta)} \right)^{-\frac{1}{0.5}}}$$

Example with Units

$$2.9964\,\text{m} = \frac{6\,\text{m}}{\left(\frac{0.408}{\tan(30°)} \right)^{-\frac{1}{0.5}}}$$

Evaluate Formula

15) Empirically Determined Functions of Beach Slope Parameter a Formula

Formula

$$a = 43.8 \cdot \left(1 - e^{-19 \cdot \tan(\beta)} \right)$$

Example with Units

$$43.7992 = 43.8 \cdot \left(1 - e^{-19 \cdot \tan(30°)} \right)$$

Evaluate Formula

16) Empirically Determined Functions of Beach Slope Parameter b Formula

Formula

$$b = \frac{1.56}{1 + e^{-19.5 \cdot \tan(\beta)}}$$

Example with Units

$$1.56 = \frac{1.56}{1 + e^{-19.5 \cdot \tan(30°)}}$$

Evaluate Formula

17) Maximum Runup Formula

Formula

$$R = H_{d'} \cdot 2.32 \cdot \varepsilon_0^{0.77}$$

Example with Units

$$19.9646\,\text{m} = 1.27\,\text{m} \cdot 2.32 \cdot 12^{0.77}$$

Evaluate Formula

18) Mean Runup Formula

Formula

$$R' = H_d \cdot 0.88 \cdot \varepsilon_0^{0.69}$$

Example with Units

$$29.3271\,\text{m} = 6.0\,\text{m} \cdot 0.88 \cdot 12^{0.69}$$

Evaluate Formula

19) Runup Exceeded by 2 Percent of Runup Crests Formula

Formula

$$R_{2\%} = H_d \cdot 1.86 \cdot \varepsilon_0^{0.71}$$

Example with Units

$$65.1453\,\text{m} = 6.0\,\text{m} \cdot 1.86 \cdot 12^{0.71}$$

Evaluate Formula

20) Surf Similarity Parameter given Average of Highest One Third of Runups Formula ↗

Formula

$$\varepsilon_0 = \left(\frac{R_{1/3}}{H_d} \cdot 1.38 \right)^{\frac{1}{0.7}}$$

Example with Units

$$29.9843 = \left(\frac{47\,\text{m}}{6.0\,\text{m}} \cdot 1.38 \right)^{\frac{1}{0.7}}$$

21) Wave Period given Long Wave Simplification for Wavelength Formula ↗

Formula

$$P = \frac{\lambda}{\sqrt{[g] \cdot H}}$$

Example with Units

$$1.0303 = \frac{26.8\,\text{m}}{\sqrt{9.8066\,\text{m/s}^2 \cdot 69\,\text{m}}}$$

Variables used in list of Irregular Waves Formulas above

- **a** Functions of Beach Slope A
- **b** Functions of Beach Slope B
- **H** Wave Height *(Meter)*
- H_d Deepwater Wave Height *(Meter)*
- $H_{d'}$ Deepwater Wave Height of Coast *(Meter)*
- H_o Wave Height of Surf Zone Waves *(Meter)*
- L_o Length of Surf Zone Waves *(Meter)*
- **P** Wave Period in Coasts
- **R** Wave Runup *(Meter)*
- **R'** Mean Runup *(Meter)*
- $R_{1/10}$ Average of the Highest 1/10 of the Runup *(Meter)*
- $R_{1/3}$ Average of the Highest 1/3 of the Runups *(Meter)*
- $R_{2\%}$ Runup Exceeded by 2 Percent of the Runup Crests *(Meter)*
- **β** Slope of Beach of Surf Zone Waves *(Degree)*
- $ε_0$ Deepwater Surf Similarity Parameter
- **λ** Wavelength of Coast *(Meter)*
- $ξ_o$ Surf Zone Waves Similarity Parameter

Constants, Functions, Measurements used in list of Irregular Waves Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- constant(s): **e**, 2.71828182845904523536028747135266249
  Napier's constant
- 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: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion ➡
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion ➡

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