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Irregular Waves Formulas

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List of 21 Irregular Waves Formulas

Irregular Waves

1) Average of Highest One Tenth of Runups

Open Calculator

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

ex $$59.54137\text{m} = 6.0\text{m} \cdot 1.7 \cdot (12)^{0.71}$$

2) Average of Highest One Third of Runups

Open Calculator

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

ex $$47.14734\text{m} = 6.0\text{m} \cdot 1.38 \cdot (12)^{0.7}$$

3) Deepwater Surf Similarity Parameter

Open Calculator

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

ex $$0.408248 = \tan(30^\circ) \cdot \left(\frac{6\text{m}}{3.0\text{m}}\right)^{-0.5}$$

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

Open Calculator

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

ex $$12.13039 = \left(\frac{60\text{m}}{6.0\text{m} \cdot 1.7}\right)^{\frac{1}{0.71}}$$

5) Deepwater Surf Similarity Parameter given Maximum Runup

Open Calculator

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

ex $$14.24699 = \left(\frac{20\text{m}}{6.0\text{m}} \cdot 2.32\right)^{\frac{1}{0.77}}$$

6) Deepwater Surf Similarity Parameter given Mean Runup

Open Calculator

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

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

7) Deepwater Surf Similarity Parameter given Runup

Open Calculator

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

$$11.96233 = \left(\frac{65\text{m}}{6.0\text{m} \cdot 1.86} \right)^{\frac{1}{0.71}}$$

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

Open Calculator

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

$$6.046216\text{m} = \frac{60\text{m}}{1.7 \cdot (12)^{0.71}}$$

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

Open Calculator

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

$$5.981249\text{m} = \frac{47\text{m}}{1.38 \cdot (12)^{0.7}}$$

10) Deepwater Wave Height given Maximum Runup

Open Calculator

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

ex $$1.27225\text{m} = \frac{20\text{m}}{2.32 \cdot (12)^{0.77}}$$

11) Deepwater Wave Height given Mean Runup

Open Calculator

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

ex $$8.960998\text{m} = \frac{43.80\text{m}}{0.88 \cdot (12)^{0.69}}$$

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

Open Calculator

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

ex $$5.98662\text{m} = \frac{65\text{m}}{1.86 \cdot (12)^{0.71}}$$

13) Deepwater Wave Height given Surf Similarity Parameter

Open Calculator

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

ex $$6.007305\text{m} = 3.0\text{m} \cdot \left(\frac{0.408}{\tan(30^\circ)} \right)^{-\frac{1}{0.5}}$$

14) Deepwater Wavelength given Surf Similarity Parameter

Open Calculator

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

ex $$2.996352\text{m} = \frac{6\text{m}}{\left(\frac{0.408}{\tan(30^\circ)} \right)^{-\frac{1}{0.5}}}$$

15) Empirically Determined Functions of Beach Slope Parameter a

Open Calculator

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

ex $$43.79925 = 43.8 \cdot \left(1 - e^{-19 \cdot \tan(30^\circ)} \right)$$

16) Empirically Determined Functions of Beach Slope Parameter b

Open Calculator

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

ex $$1.55998 = \frac{1.56}{1 + e^{-19.5 \cdot \tan(30^\circ)}}$$

17) Maximum Runup

Open Calculator

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

ex $$19.96463\text{m} = 1.27\text{m} \cdot 2.32 \cdot (12)^{0.77}$$

18) Mean Runup

Open Calculator

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

ex $$29.32709\text{m} = 6.0\text{m} \cdot 0.88 \cdot (12)^{0.69}$$

19) Runup Exceeded by 2 Percent of Runup Crests

Open Calculator

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

ex $$65.14527\text{m} = 6.0\text{m} \cdot 1.86 \cdot (12)^{0.71}$$

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

Open Calculator

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

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

21) Wave Period given Long Wave Simplification for Wavelength

Open Calculator

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

ex $$1.030267 = \frac{26.8\text{m}}{\sqrt{[g] \cdot 69\text{m}}}$$

Variables Used

- **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

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Constant: **e**, 2.71828182845904523536028747135266249
  Napier's constant
- Function: **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.
- Function: **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

Check other formula lists

- **Breaker Index Formulas**
- **Energy Flux Method Formulas**
- **Irregular Waves Formulas**

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