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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

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

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

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

2) Average of Highest One Third of Runups

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

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

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

3) Deepwater Surf Similarity Parameter

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

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

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

5) Deepwater Surf Similarity Parameter given Maximum Runup

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

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

6) Deepwater Surf Similarity Parameter given Mean Runup

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

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



7) Deepwater Surf Similarity Parameter given Runup

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

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

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


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

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

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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



10) Deepwater Wave Height given Maximum Runup 

$$\text{fx } H_d' = \frac{R}{2.32 \cdot \varepsilon_0^{0.77}}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

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

11) Deepwater Wave Height given Mean Runup 

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

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

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



13) Deepwater Wave Height given Surf Similarity Parameter

[Open Calculator !\[\]\(eafc244b53721dd1ec133f0772f70fc7_img.jpg\)](#)

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

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

14) Deepwater Wavelength given Surf Similarity Parameter

[Open Calculator !\[\]\(10f8862fc183b400327470ea85afe9ae_img.jpg\)](#)

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

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

15) Empirically Determined Functions of Beach Slope Parameter a

[Open Calculator !\[\]\(35dc653d59570f8f891c312eeece91a2_img.jpg\)](#)

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

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



16) Empirically Determined Functions of Beach Slope Parameter b

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

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

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

17) Maximum Runup

$$fx \quad R = H_d \cdot 2.32 \cdot \varepsilon_0^{0.77}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

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

18) Mean Runup

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

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

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

19) Runup Exceeded by 2 Percent of Runup Crests

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

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

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

21) Wave Period given Long Wave Simplification for Wavelength

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

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

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





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_o** 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 



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