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Shoaling, Refraction and Breaking Formulas

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List of 16 Shoaling, Refraction and Breaking Formulas

Shoaling, Refraction and Breaking

1) Beach Slope given Breaking Wave and Wave Height at Breaking Point

Open Calculator

fx $$\beta = \xi \cdot \sqrt{\frac{H_w}{\lambda_o}}$$

ex $$0.149916\text{rad} = 0.229 \cdot \sqrt{\frac{3\text{m}}{7\text{m}}}$$

2) Breaking Wave given wave height at Breaking Point

Open Calculator

fx $$\xi = \frac{\beta}{\sqrt{\frac{H_w}{\lambda_o}}}$$

ex $$0.229129 = \frac{0.15\text{rad}}{\sqrt{\frac{3\text{m}}{7\text{m}}}}$$

3) Deepwater Wave Height for Shoaling Coefficient and Refraction Coefficient

Open Calculator

$$H_o = \frac{H_w}{K_s \cdot K_r}$$

$$31.74603\text{m} = \frac{3\text{m}}{0.945 \cdot 0.1}$$

4) Deepwater Wavelength for Shoaling Coefficient in Shallow Water

Open Calculator

$$\lambda_o = \left(\frac{K_s}{0.4466}\right)^4 \cdot d_w$$

$$8.018855\text{m} = \left(\frac{0.945}{0.4466}\right)^4 \cdot 0.4\text{m}$$

5) Deepwater Wavelength given Wave Breaking and Wave Height at Breaking Point

Open Calculator

$$\lambda_o = \frac{\xi^2 \cdot H_w}{\beta^2}$$

$$6.992133\text{m} = \frac{(0.229)^2 \cdot 3\text{m}}{(0.15\text{rad})^2}$$

6) Distance between Two Rays at General Point

Open Calculator

fx $$b = \frac{b_0}{K_r^2}$$

ex $$10000\text{m} = \frac{100\text{m}}{(0.1)^2}$$

7) Refraction Coefficient

Open Calculator

fx $$K_r = \sqrt{\frac{b_0}{b}}$$

ex $$0.1 = \sqrt{\frac{100\text{m}}{10000\text{m}}}$$

8) Refraction Coefficient given Relative Change of Wave Height

Open Calculator

fx $$K_r = \frac{H_w}{H_o \cdot K_s}$$

ex $$0.100558 = \frac{3\text{m}}{31.57\text{m} \cdot 0.945}$$

9) Shoaling Coefficient

Open Calculator

$$K_s = \left(\tanh(k \cdot d) \cdot \left(1 + \left(2 \cdot k \cdot \frac{d}{\sinh(2 \cdot k \cdot d)}\right)\right)\right)^{-0.5}$$

ex

$$0.951161 = \left(\tanh(0.2 \cdot 10\text{m}) \cdot \left(1 + \left(2 \cdot 0.2 \cdot \frac{10\text{m}}{\sinh(2 \cdot 0.2 \cdot 10\text{m})}\right)\right)\right)^{-0.5}$$

10) Shoaling Coefficient given Wave Celerity

Open Calculator

$$K_s = \sqrt{\frac{C_o}{C \cdot 2 \cdot n}}$$

ex

$$0.67082 = \sqrt{\frac{4.5\text{m/s}}{20\text{m/s} \cdot 2 \cdot 0.25}}$$

11) Shoaling Coefficient in Shallow Water

Open Calculator

$$K_s = 0.4466 \cdot \left(\frac{\lambda_o}{d_w}\right)^{\frac{1}{4}}$$

ex

$$0.913436 = 0.4466 \cdot \left(\frac{7\text{m}}{0.4\text{m}}\right)^{\frac{1}{4}}$$

12) Water Depth given Shoaling Coefficient in Shallow Water

Open Calculator

fx $$d_w = \frac{\lambda_o}{\left(\frac{K_s}{0.4466}\right)^4}$$

ex $$0.349177\text{m} = \frac{7\text{m}}{\left(\frac{0.945}{0.4466}\right)^4}$$

13) Water Depth when Reduced Shoaling Coefficient in Shallow Water

Open Calculator

fx $$d_w = \frac{\lambda_o}{\left(\frac{K_s}{0.2821}\right)^2}$$

ex $$0.623793\text{m} = \frac{7\text{m}}{\left(\frac{0.945}{0.2821}\right)^2}$$

14) Wave Height at Breaking Point given Breaking Wave

Open Calculator

fx $$H_w = \frac{\lambda_o \cdot \beta^2}{\xi^2}$$

ex $$3.003375\text{m} = \frac{7\text{m} \cdot (0.15\text{rad})^2}{(0.229)^2}$$

15) Wave Height given Shoaling Coefficient and Refraction Coefficient

Open Calculator

fx $$H_w = H_o \cdot K_s \cdot K_r$$

ex $$2.983365\text{m} = 31.57\text{m} \cdot 0.945 \cdot 0.1$$

16) Wave Length for Reduced Shoaling Coefficient in Shallow Water

Open Calculator

fx $$\lambda_o = d_w \cdot \left(\frac{K_s}{0.2821} \right)^2$$

ex $$4.488667\text{m} = 0.4\text{m} \cdot \left(\frac{0.945}{0.2821} \right)^2$$

Variables Used

- **b** Distance Between Two Rays *(Meter)*
- b_0 Distance Between Two Rays at Deepwater *(Meter)*
- **C** Celerity of the Wave *(Meter per Second)*
- C_o Deepwater Wave Celerity *(Meter per Second)*
- **d** Coastal Mean Depth *(Meter)*
- d_w Water Depth in Ocean *(Meter)*
- H_o Wave Height in Deepwater *(Meter)*
- H_w Wave Height for Surface Gravity Waves *(Meter)*
- **k** Wave Number for Water Wave
- K_r Refraction Coefficient
- K_s Shoaling Coefficient
- **n** Ratio of Group Velocity to Phase Velocity
- **β** Beach Slope *(Radian)*
- λ_o Deep-Water Wavelength *(Meter)*
- **ξ** Breaking Wave

Constants, Functions, Measurements used

- Function: **sinh**, sinh(Number)
  The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.
- 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: **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: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion

Check other formula lists

- **Group Velocity, Beats, Energy Transport Formulas**
- **Linear Dispersion Relation of Linear Wave Formulas**
- **Non-Linear Wave Theory Formulas**
- **Shoaling, Refraction and Breaking Formulas**

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