Important Group Velocity, Beats, Energy Transport Formulas PDF

Formulas
Examples
with Units

List of 9
Important Group Velocity, Beats, Energy Transport Formulas

1) Group Velocity given Wave Power per unit Crest Width Formula

Evaluate Formula

Formula

$$V_g = \frac{P}{E}$$

Example with Units

$$28.7081\,\text{m/s} = \frac{120\,\text{W}}{4.18\,\text{J}}$$

2) Group Velocity of Waves Formula

Evaluate Formula

Formula

$$V_g = 0.5 \cdot v \cdot \left(1 + \left(\frac{k \cdot d}{\sinh(k \cdot d) \cdot \cosh(k \cdot d)}\right)\right)$$

Example with Units

$$28.6644\,\text{m/s} = 0.5 \cdot 50\,\text{m/s} \cdot \left(1 + \left(\frac{0.2 \cdot 10\,\text{m}}{\sinh(0.2 \cdot 10\,\text{m}) \cdot \cosh(0.2 \cdot 10\,\text{m})}\right)\right)$$

3) Radian Frequency given Wave Propagation Formula

Evaluate Formula

Formula

$$\omega = k \cdot x$$

Example with Units

$$6.2\,\text{rad/s} = 0.2 \cdot 31$$

4) Surface Elevation Formula

Evaluate Formula

Formula

$$\eta = \left(\frac{H_w}{2}\right) \cdot \cos((k \cdot x) - (\omega \cdot t))$$

Example with Units

$$0.4761\,\text{m} = \left(\frac{3\,\text{m}}{2}\right) \cdot \cos((0.2 \cdot 31) - (6.2\,\text{rad/s} \cdot 16\,\text{s}))$$

5) Total Energy per unit Area given Wave Power per unit Crest Width Formula

Evaluate Formula

Formula

$$E = \frac{P}{V_g}$$

Example with Units

$$4.187\,\text{J} = \frac{120\,\text{W}}{28.66\,\text{m/s}}$$

6) Wave Power per unit Crest Width Formula

Evaluate Formula

Formula

$$P = E \cdot V_g$$

Example with Units

$$119.7988\,\text{W} = 4.18\,\text{J} \cdot 28.66\,\text{m/s}$$

7) Wave Speed Formula

Evaluate Formula

Formula

$$v = \frac{\omega}{k''}$$

Example with Units

$$50\,\text{m/s} = \frac{6.2\,\text{rad/s}}{0.124}$$

8) Wave Speed given Group Velocity Formula

Evaluate Formula

Formula

$$v = \frac{V_g}{0.5 \cdot \left(1 + \left(\frac{k \cdot d}{\sinh(k \cdot d) \cdot \cosh(k \cdot d)}\right)\right)}$$

Example with Units

$$49.9924\,\text{m/s} = \frac{28.66\,\text{m/s}}{0.5 \cdot \left(1 + \left(\frac{0.2 \cdot 10\,\text{m}}{\sinh(0.2 \cdot 10\,\text{m}) \cdot \cosh(0.2 \cdot 10\,\text{m})}\right)\right)}$$

9) Wavenumber given Wave Speed Formula

Evaluate Formula

Formula

$$k'' = \frac{\omega}{v}$$

Example with Units

$$0.124 = \frac{6.2\,\text{rad/s}}{50\,\text{m/s}}$$

Variables used in list of Group Velocity, Beats, Energy Transport Formulas above

- **d** Coastal Mean Depth *(Meter)*
- **E** Total Energy Per Unit Area *(Joule)*
- H_w Wave Height for Surface Gravity Waves *(Meter)*
- **k** Wave Number for Water Wave
- k'' Wave Number
- **P** Wave Power Per Unit Crest Width *(Watt)*
- **t** Time *(Second)*
- **v** Wave Speed *(Meter per Second)*
- V_g Group Velocity of Waves *(Meter per Second)*
- **x** Propagation of Wave in One Direction
- **η** Surface Elevation *(Meter)*
- **ω** Wave Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Group Velocity, Beats, Energy Transport Formulas above

- Functions: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Functions: **cosh**, cosh(Number)
  The hyperbolic cosine function is a mathematical function that is defined as the ratio of the sum of the exponential functions of x and negative x to 2.
- Functions: **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.
- 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: **Energy** in Joule (J)
  Energy Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

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