Important Prediction of Tides and Tidal Rivers Formulas PDF

Formulas
Examples
with Units

List of 14
Important Prediction of Tides and Tidal Rivers Formulas

1) Harmonic Analysis and Prediction of Tides Formulas

1.1) Form Number Formula

Evaluate Formula

Formula

$$F = \frac{O_1 + K_1}{M_2 + S_2}$$

Example

$$0.7895 = \frac{3 + 12}{8 + 11}$$

1.2) Lunar-Solar Constituent given Form Number Formula

Evaluate Formula

Formula

$$K_1 = F \cdot \left(M_2 + S_2 \right) - O_1$$

Example

$$11.9986 = 0.7894 \cdot \left(8 + 11 \right) - 3$$

1.3) Principal Lunar Diurnal Constituent given Form Number Formula

Evaluate Formula

Formula

$$O_1 = F \cdot \left(M_2 + S_2 \right) - K_1$$

Example

$$2.9986 = 0.7894 \cdot \left(8 + 11 \right) - 12$$

1.4) Principal Lunar Semi-Diurnal Constituent given Form Number Formula

Evaluate Formula

Formula

$$M_2 = \left(\frac{O_1 + K_1}{F} \right) - S_2$$

Example

$$8.0018 = \left(\frac{3 + 12}{0.7894} \right) - 11$$

1.5) Principal Solar Semi-Diurnal Constituent given Form Number Formula

Evaluate Formula

Formula

$$S_2 = \left(\frac{O_1 + K_1}{F} \right) - M_2$$

Example

$$11.0018 = \left(\frac{3 + 12}{0.7894} \right) - 8$$

1.6) Radian Frequencies for Prediction of Tides Formula

Evaluate Formula

Formula

$$\omega = 2 \cdot \frac{\pi}{T_n}$$

Example with Units

$$6.2001\,\text{rad/s} = 2 \cdot \frac{3.1416}{1.0134\,\text{s}}$$

1.7) Time Period of n'th Contribution of Tide Prediction given Radian Frequencies Formula

Evaluate Formula

Formula

$$T_n = 2 \cdot \frac{\pi}{\omega}$$

Example with Units

$$1.0134\,\text{s} = 2 \cdot \frac{3.1416}{6.2\,\text{rad/s}}$$

2) Tidal Rivers Formulas

2.1) River Navigation Formulas

2.1.1) Average Depth given Friction Factor for Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$h' = \frac{T \cdot 8 \cdot [g] \cdot V_{max}}{6 \cdot \pi^2 \cdot C^2 \cdot \tan\left(\frac{\theta_f}{0.5}\right)}$$

Example with Units

$$26\,\text{m} = \frac{130\,\text{s} \cdot 8 \cdot 9.8066\,\text{m/s}^2 \cdot 58.832\,\text{m}^3\text{/s}}{6 \cdot 3.1416^2 \cdot 15^2 \cdot \tan\left(\frac{30°}{0.5}\right)}$$

2.1.2) Average Depth given Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$h' = \frac{v^2}{[g] \cdot \left(1 - \tan\left(\theta_f\right)^2\right)}$$

Example with Units

$$27.0566\,\text{m} = \frac{13.3\,\text{m/s}^2}{9.8066\,\text{m/s}^2 \cdot \left(1 - \tan\left(30°\right)^2\right)}$$

2.1.3) Chezy's Friction Factor given Friction Factor for Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$C = \sqrt{\frac{T \cdot 8 \cdot [g] \cdot V_{max}}{6 \cdot \pi^2 \cdot h' \cdot \tan\left(\frac{\theta_f}{0.5}\right)}}$$

Example with Units

$$15 = \sqrt{\frac{130\,\text{s} \cdot 8 \cdot 9.8066\,\text{m/s}^2 \cdot 58.832\,\text{m}^3\text{/s}}{6 \cdot 3.1416^2 \cdot 26\,\text{m} \cdot \tan\left(\frac{30°}{0.5}\right)}}$$

2.1.4) Friction Factor for Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$\Theta_f = 0.5 \cdot a\tan\left(T \cdot 8 \cdot [g] \cdot \frac{V_{max}}{6 \cdot \pi^2 \cdot C^2 \cdot h'} \right)$$

Example with Units

$$30° = 0.5 \cdot a\tan\left(130\,s \cdot 8 \cdot 9.8066\,m/s^2 \cdot \frac{58.832\,m^3/s}{6 \cdot 3.1416^2 \cdot 15^2 \cdot 26\,m} \right)$$

2.1.5) Maximum Flood Current given Friction Factor for Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$V_{max} = \frac{6 \cdot \pi^2 \cdot C^2 \cdot h' \cdot \tan\left(\frac{\Theta_f}{0.5}\right)}{T \cdot 8 \cdot [g]}$$

Example with Units

$$58.832\,m^3/s = \frac{6 \cdot 3.1416^2 \cdot 15^2 \cdot 26\,m \cdot \tan\left(\frac{30°}{0.5}\right)}{130\,s \cdot 8 \cdot 9.8066\,m/s^2}$$

2.1.6) Propagation velocity of tide wave Formula

Evaluate Formula

Formula

$$v = \sqrt{[g] \cdot h' \cdot \left(1 - \tan\left(\Theta_f\right)^2\right)}$$

Example with Units

$$13.0377\,m/s = \sqrt{9.8066\,m/s^2 \cdot 26\,m \cdot \left(1 - \tan\left(30°\right)^2\right)}$$

2.1.7) Tidal Period for Friction Factor and Propagation Velocity of Tide Wave Formula

Evaluate Formula

Formula

$$T = \frac{6 \cdot \left(\pi^2\right) \cdot \left(C^2\right) \cdot h' \cdot \tan\left(\frac{\Theta_f}{0.5}\right)}{8 \cdot [g] \cdot V_{max}}$$

Example with Units

$$130\,s = \frac{6 \cdot \left(3.1416^2\right) \cdot \left(15^2\right) \cdot 26\,m \cdot \tan\left(\frac{30°}{0.5}\right)}{8 \cdot 9.8066\,m/s^2 \cdot 58.832\,m^3/s}$$

Variables used in list of Prediction of Tides and Tidal Rivers Formulas above

- **C** Chezy's Constant
- **F** Form Number
- **h'** Average Depth *(Meter)*
- K_1 Lunar Solar Constituent
- M_2 Principal Lunar Semi-Diurnal Constituent
- O_1 Principal Lunar Diurnal Constituent
- S_2 Principal Solar Semi-Diurnal Constituent
- **T** Tidal Period *(Second)*
- T_n Period of the nth Contribution *(Second)*
- **v** Wave Speed *(Meter per Second)*
- V_{max} Maximum Flood Current *(Cubic Meter per Second)*
- Θ_f Friction Factor in Terms of Degree *(Degree)*
- **ω** Wave Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Prediction of Tides and Tidal Rivers Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[g]**, 9.80665 *Gravitational acceleration on Earth*
- Functions: **atan**, atan(Number) *Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.*
- 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: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s) *Volumetric Flow Rate Unit Conversion*
- Measurement: **Angular Frequency** in Radian per Second (rad/s) *Angular Frequency Unit Conversion*

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