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Calculation of Forces on Ocean Structures Formulas

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List of 17 Calculation of Forces on Ocean Structures Formulas

Calculation of Forces on Ocean Structures

The Keulegan-Carpenter Number

1) Amplitude of Flow Velocity Oscillation

Open Calculator

fx $$V_{fv} = \frac{K_C \cdot L}{T}$$

ex $$3.870968\text{m/s} = \frac{8 \cdot 30\text{m}}{62\text{s}}$$

2) Amplitude of Flow Velocity Oscillation for Sinusoidal Motion of Fluid

Open Calculator

fx $$V_{fv} = \frac{A \cdot 2 \cdot \pi}{T}$$

ex $$4.053668\text{m/s} = \frac{40 \cdot 2 \cdot \pi}{62\text{s}}$$

3) Characteristic Length Scale of Object

Open Calculator

fx $$L = \frac{V_{fv} \cdot T}{K_C}$$

ex $$31\text{m} = \frac{4\text{m/s} \cdot 62\text{s}}{8}$$

4) Characteristic Length Scale of Object given Displacement Parameter

Open Calculator

fx $$L = \frac{A}{\delta}$$

ex $$26.66667\text{m} = \frac{40}{1.5}$$

5) Displacement Parameter for Sediment Transport for Sinusoidal Motion of Fluid

Open Calculator

fx $$\delta = \frac{K_C}{2 \cdot \pi}$$

ex $$1.27324 = \frac{8}{2 \cdot \pi}$$

6) Displacement Parameter for Sediment Transport under Water Waves

Open Calculator

fx $$\delta = \frac{A}{L}$$

ex $$1.333333 = \frac{40}{30\text{m}}$$

7) Excursion Amplitude of Fluid Particles in Oscillatory Flow given Displacement Parameter

Open Calculator

fx $$A = \delta \cdot L$$

ex $$45 = 1.5 \cdot 30\text{m}$$

8) Keulegan-Carpenter Number

Open Calculator

$$K_C = \frac{V_{fv} \cdot T}{L}$$

$$8.266667 = \frac{4\text{m/s} \cdot 62\text{s}}{30\text{m}}$$

9) Keulegan-Carpenter Number for Sinusoidal Motion of Fluid

Open Calculator

$$K_C = 2 \cdot \pi \cdot \delta$$

$$9.424778 = 2 \cdot \pi \cdot 1.5$$

10) Period of Oscillation

Open Calculator

$$T = \frac{K_C \cdot L}{V_{fv}}$$

$$60\text{s} = \frac{8 \cdot 30\text{m}}{4\text{m/s}}$$

11) Period of Oscillation for Sinusoidal Motion of Fluid

Open Calculator

$$T = \frac{A \cdot 2 \cdot \pi}{V_{fv}}$$

$$62.83185\text{s} = \frac{40 \cdot 2 \cdot \pi}{4\text{m/s}}$$

The Morison (MOJS) Equation

12) Added-Mass Coefficient for Fixed Body in Oscillatory Flow

Open Calculator

$$C_a = C_m - 1$$

$$4 = 5 - 1$$

13) Drag Force for Fixed body in Oscillatory Flow

Open Calculator

$$F_D = 0.5 \cdot \rho_{Fluid} \cdot C_D \cdot S \cdot V_f^2$$

$$0.102913\text{kN} = 0.5 \cdot 1.225\text{kg/m}^3 \cdot 0.30 \cdot 5.08\text{m}^2 \cdot (10.5\text{m/s})^2$$

14) Froude-Krylov Force

Open Calculator

$$F_k = \rho_{Fluid} \cdot V \cdot u'$$

$$6.125\text{kN} = 1.225\text{kg/m}^3 \cdot 50\text{m}^3 \cdot 100\text{m}^3/\text{s}$$

15) Hydrodynamic Mass Force

Open Calculator

$$F = \rho_{Fluid} \cdot C_a \cdot V \cdot u'$$

$$27.5625\text{kN} = 1.225\text{kg/m}^3 \cdot 4.5 \cdot 50\text{m}^3 \cdot 100\text{m}^3/\text{s}$$

16) Inertia Coefficient for Fixed body in Oscillatory Flow

Open Calculator

$$C_m = 1 + C_a$$

$$5.5 = 1 + 4.5$$

17) Inertia Force for Fixed body in Oscillatory Flow

Open Calculator

fx $F_i = \rho_{Fluid} \cdot C_m \cdot V \cdot u'$

ex $30.625\text{kN} = 1.225\text{kg/m}^3 \cdot 5 \cdot 50\text{m}^3 \cdot 100\text{m}^3/\text{s}$

Variables Used

- **A** Excursion Amplitude of Fluid Particles
- **C_a** Added Mass Coefficient
- **C_D** Drag Coefficient of Fluid
- **C_m** Inertia Coefficient
- **F** Hydrodynamic Mass Force *(Kilonewton)*
- **F_D** Drag Force *(Kilonewton)*
- **F_i** Inertia Force of Fluid *(Kilonewton)*
- **F_k** Froude-Krylov Force *(Kilonewton)*
- **K_C** Keulegan-Carpenter Number
- **L** Length Scale *(Meter)*
- **S** Reference Area *(Square Meter)*
- **T** Time Period of Oscillations *(Second)*
- **u'** Flow Acceleration *(Cubic Meter per Second)*
- **V** Volume of Body *(Cubic Meter)*
- **V_f** Flow Velocity *(Meter per Second)*
- **V_{fv}** Amplitude of Flow Velocity Oscillation *(Meter per Second)*
- **δ** Displacement Parameter
- **ρ_{Fluid}** Density of Fluid *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion

Check other formula lists

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