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Nonlifting Flow over Cylinder Formulas

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List of 10 Nonlifting Flow over Cylinder Formulas

Nonlifting Flow over Cylinder

1) Angular Position given Pressure Coefficient for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$\theta = ar\sin\left(\frac{\sqrt{1-(C_p)}}{2}\right)$$

ex $$1.083497\text{rad} = ar\sin\left(\frac{\sqrt{1-(-2.123)}}{2}\right)$$

2) Angular Position given Radial Velocity for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$\theta = \arccos\left(\frac{V_r}{\left(1-\left(\frac{R}{r}\right)^2\right)\cdot V_\infty}\right)$$

ex $$0.902545\text{rad} = \arccos\left(\frac{3.9\text{m/s}}{\left(1-\left(\frac{0.08\text{m}}{0.27\text{m}}\right)^2\right)\cdot 6.9\text{m/s}}\right)$$

3) Angular Position given Tangential Velocity for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$\theta = -ar\sin\left(\frac{V_\theta}{\left(1+\frac{R^2}{r^2}\right)\cdot V_\infty}\right)$$

ex $$0.99365\text{rad} = -ar\sin\left(\frac{-6.29\text{m/s}}{\left(1+\frac{(0.08\text{m})^2}{(0.27\text{m})^2}\right)\cdot 6.9\text{m/s}}\right)$$

4) Doublet Strength given Radius of Cylinder for Non-Lifting Flow

Open Calculator

fx $$\kappa = R^2\cdot 2\cdot\pi\cdot V_\infty$$

ex $$0.277465\text{m}^3\text{/s} = (0.08\text{m})^2\cdot 2\cdot\pi\cdot 6.9\text{m/s}$$

5) Freestream Velocity given Doublet Strength for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$V_\infty = \frac{\kappa}{R^2\cdot 2\cdot\pi}$$

ex $$5.470951\text{m/s} = \frac{0.22\text{m}^3\text{/s}}{(0.08\text{m})^2\cdot 2\cdot\pi}$$

6) Radial Velocity for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$V_r = \left(1 - \left(\frac{R}{r}\right)^2\right) \cdot V_\infty \cdot \cos(\theta)$$

ex $$3.912562\text{m/s} = \left(1 - \left(\frac{0.08\text{m}}{0.27\text{m}}\right)^2\right) \cdot 6.9\text{m/s} \cdot \cos(0.9\text{rad})$$

7) Radius of Cylinder for Non-Lifting Flow

Open Calculator

fx $$R = \sqrt{\frac{\kappa}{2 \cdot \pi \cdot V_\infty}}$$

ex $$0.071236\text{m} = \sqrt{\frac{0.22\text{m}^3/\text{s}}{2 \cdot \pi \cdot 6.9\text{m/s}}}$$

8) Stream Function for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $$\psi = V_\infty \cdot r \cdot \sin(\theta) \cdot \left(1 - \left(\frac{R}{r}\right)^2\right)$$

ex $$1.331221\text{m}^2/\text{s} = 6.9\text{m/s} \cdot 0.27\text{m} \cdot \sin(0.9\text{rad}) \cdot \left(1 - \left(\frac{0.08\text{m}}{0.27\text{m}}\right)^2\right)$$

9) Surface Pressure Coefficient for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $C_p = 1 - 4 \cdot (\sin(\theta))^2$

ex $-1.454404 = 1 - 4 \cdot (\sin(0.9\text{rad}))^2$

10) Tangential Velocity for Non-Lifting Flow over Circular Cylinder

Open Calculator

fx $V_\theta = -\left(1 + \left(\frac{R}{r}\right)^2\right) \cdot V_\infty \cdot \sin(\theta)$

ex $-5.879465\text{m/s} = -\left(1 + \left(\frac{0.08\text{m}}{0.27\text{m}}\right)^2\right) \cdot 6.9\text{m/s} \cdot \sin(0.9\text{rad})$

Variables Used

- C_p Surface Pressure Coefficient
- **r** Radial Coordinate *(Meter)*
- **R** Cylinder Radius *(Meter)*
- V_∞ Freestream Velocity *(Meter per Second)*
- V_r Radial Velocity *(Meter per Second)*
- V_θ Tangential Velocity *(Meter per Second)*
- **θ** Polar Angle *(Radian)*
- **κ** Doublet Strength *(Cubic Meter per Second)*
- **ψ** Stream Function *(Square Meter per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **arccos**, arccos(Number)
  Inverse trigonometric cosine function
- Function: **arsin**, arsin(Number)
  Inverse trigonometric sine function
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- 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
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Velocity Potential** in Square Meter per Second (m^2/s)
  Velocity Potential Unit Conversion

Check other formula lists

- **Lifting Flow over Cylinder Formulas**
- **Nonlifting Flow over Cylinder Formulas**

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