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Approximate Methods of Hypersonic Inviscid Flowfields Formulas

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List of 11 Approximate Methods of Hypersonic Inviscid Flowfields Formulas

Approximate Methods of Hypersonic Inviscid Flowfields

1) Non-Dimensional Density

Open Calculator

fx $$\rho_{-} = \frac{\rho}{\rho_{liq}}$$

ex $$4.300259 = \frac{663.1\text{kg/m}^3}{154.2\text{kg/m}^3}$$

2) Non-Dimensional Density for High Mach Number

Open Calculator

fx $$\rho_{-} = \frac{\gamma + 1}{\gamma - 1}$$

ex $$4.333333 = \frac{1.6 + 1}{1.6 - 1}$$

3) Non-Dimensional Parallel Velocity Component for High Mach Number

Open Calculator

fx $$u_{-} = 1 - \frac{2 \cdot (\sin(\beta))^2}{\gamma - 1}$$

ex $$0.7347 = 1 - \frac{2 \cdot (\sin(0.286\text{rad}))^2}{1.6 - 1}$$

4) Non-Dimensional Perpendicular Velocity Component for High Mach Number

Open Calculator

fx $$v_{-} = \frac{\sin(2 \cdot \beta)}{\gamma - 1}$$

ex $$0.902191 = \frac{\sin(2 \cdot 0.286\text{rad})}{1.6 - 1}$$

5) Non-Dimensional Pressure

Open Calculator

fx $$p_{-} = \frac{P}{\rho \cdot V_{\infty}^2}$$

ex $$0.800045 = \frac{800\text{Pa}}{663.1\text{kg/m}^3 \cdot (1.228\text{m/s})^2}$$

6) Non-Dimensional Pressure for High Mach Number

Open Calculator

fx $$p_{mech} = 2 \cdot \frac{(\sin(\beta))^2}{\gamma + 1}$$

ex $$0.061223 = 2 \cdot \frac{(\sin(0.286\text{rad}))^2}{1.6 + 1}$$

7) Non-Dimensional Radius for Hypersonic Vehicles

Open Calculator

fx $$r_{-} = \frac{R}{\lambda \cdot H}$$

ex $$1.904762 = \frac{8\text{m}}{0.5 \cdot 8.4\text{m}}$$

8) Slenderness Ratio with Cone Radius for Hypersonic Vehicle

Open Calculator

fx $$\lambda_{hyp} = \frac{R}{H}$$

ex $$0.952381 = \frac{8\text{m}}{8.4\text{m}}$$

9) Transformed Conical Variable

Open Calculator

fx $$\theta_{-} = \frac{R}{\lambda \cdot H}$$

ex $$1.904762 = \frac{8\text{m}}{0.5 \cdot 8.4\text{m}}$$

10) Transformed Conical Variable with Cone Angle in Hypersonic Flow

Open Calculator

fx $$\theta_{-} = \frac{\beta \cdot \left(\frac{180}{\pi}\right)}{\alpha}$$

ex $$1.900115 = \frac{0.286\text{rad} \cdot \left(\frac{180}{\pi}\right)}{8.624\text{rad}}$$

11) Transformed Conical Variable with Wave Angle

Open Calculator

fx $$\theta_{w} = \frac{\beta \cdot \left(\frac{180}{\pi}\right)}{\lambda}$$

ex $$32.77319 = \frac{0.286\text{rad} \cdot \left(\frac{180}{\pi}\right)}{0.5}$$

Variables Used

- **H** Height of Cone *(Meter)*
- **P** Pressure *(Pascal)*
- **p_{-}** Non Dimensionalized Pressure
- **p_{mech}** Non Dimensionalized Pressure For High Mech Number
- **R** Radius of Cone *(Meter)*
- **r_{-}** Non Dimensionalized Radius
- **u_{-}** Non Dimensionalized Upstream Parallel Velocity
- **v_{-}** Non Dimensionalized Velocity
- **V_{∞}** Freestream Velocity *(Meter per Second)*
- **α** Semi Angle of Cone *(Radian)*
- **β** Wave Angle *(Radian)*
- **γ** Specific Heat Ratio
- **θ_{-}** Transformed Conical Variable
- **θ_{w}** Transformed Conical Variable With Wave Angle
- **λ** Slenderness Ratio
- **λ_{hyp}** Slenderness Ratio For Hypersonic Vehicles
- **ρ** Density *(Kilogram per Cubic Meter)*
- **ρ_{-}** Non Dimensionalized Density
- **ρ_{liq}** Liquid Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

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