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Hypersonic Flow Parameters Formulas

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List of 7 Hypersonic Flow Parameters Formulas

Hypersonic Flow Parameters

1) Dynamic Viscosity around Wall

Open Calculator

fx $$\mu_{viscosity} = \mu_e \cdot \left(\frac{Tw}{T_{static}} \right)^n$$

ex $$11.16478P = 11.2P \cdot \left(\frac{15K}{350K} \right)^{0.001}$$

2) Local Shear Stress at Wall

Open Calculator

fx $$\tau = 0.5 \cdot C_f \cdot \rho_e \cdot u_e^2$$

ex $$58.08Pa = 0.5 \cdot 0.00125 \cdot 1200kg/m^3 \cdot (8.8m/s)^2$$

3) Local Skin-Friction Coefficient

Open Calculator

fx $$C_f = \frac{2 \cdot \tau}{\rho_e \cdot u_e^2}$$

ex $$0.001313 = \frac{2 \cdot 61Pa}{1200kg/m^3 \cdot (8.8m/s)^2}$$

4) Skin Friction Coefficient for Incompressible Flow

Open Calculator

fx $$c_f = \frac{0.664}{\sqrt{Re}}$$

ex $$0.00939 = \frac{0.664}{\sqrt{5000}}$$

5) Static Density Equation using Skin Friction Coefficient

Open Calculator

fx $$\rho_e = \frac{2 \cdot \tau}{C_f \cdot u_e^2}$$

ex $$1260.331\text{kg/m}^3 = \frac{2 \cdot 61\text{Pa}}{0.00125 \cdot (8.8\text{m/s})^2}$$

6) Static Velocity Equation using Skin Friction Coefficient

Open Calculator

fx $$u_e = \sqrt{\frac{2 \cdot \tau}{C_f \cdot \rho_e}}$$

ex $$9.0185\text{m/s} = \sqrt{\frac{2 \cdot 61\text{Pa}}{0.00125 \cdot 1200\text{kg/m}^3}}$$

7) Static Viscosity Relation using Temperature of Wall

Open Calculator

fx $$\mu_e = \frac{\mu_{viscosity}}{\left(\frac{Tw}{T_{static}}\right)^{n}}$$

ex $$10.23218P = \frac{10.2P}{\left(\frac{15K}{350K}\right)^{0.001}}$$

Variables Used

- c_f Skin friction coefficient
- C_f Local Skin-Friction Coefficient
- **n** Constant n
- **Re** Reynolds Number
- T_{static} Static Temperature *(Kelvin)*
- **Tw** Wall Temperature *(Kelvin)*
- u_e Static Velocity *(Meter per Second)*
- μ_e Static Viscosity *(Poise)*
- $\mu_{viscosity}$ Dynamic Viscosity *(Poise)*
- ρ_e Static Density *(Kilogram per Cubic Meter)*
- τ Shear Stress *(Pascal)*

Constants, Functions, Measurements used

- Function: **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.
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Dynamic Viscosity** in Poise (P)
  Dynamic Viscosity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- **Hypersonic Flow Parameters Formulas**

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