THERMODYANMICS AND COMPRESSIBLE FLOW EQUATIONS OVERVIEW

Perfect Gas Equation of State $P = \rho RT \qquad PV = N\hat{R}T$

where $N = \text{No. of Moles}$ and $R = \dfrac{\hat{R}}{\hat{M}}$

Specific Heats

$$c_p \equiv \left(\frac{\partial h}{\partial T}\right)_P = \frac{\gamma R}{\gamma - 1} = c_v + R \qquad c_v \equiv \left(\frac{\partial u}{\partial T}\right)_v = \frac{R}{\gamma - 1} \qquad \gamma \equiv \frac{c_p}{c_v}$$

$$h = u + P/\rho$$

Pressure Work $W = \int P dV$

1st Law of Thermodynamics $dE = \delta Q - \delta W$

Conservation of Energy

$$\frac{\partial}{\partial t}\iiint_{CV}(\rho h_0 - P)dV + \iint_{CS}\rho h_0(\vec{V}\cdot\vec{n})dA = \dot{Q}_{vol} + \dot{Q}_{surface} - \dot{W}_m - \dot{W}_{visc} + \iiint_{CV}\rho(\vec{f}\cdot\vec{V})dV$$