Compressible Flow – Equations

ME312 - Abata

$$h_o = h + \frac{V^2}{2}$$

$$T_o = T + \frac{V^2}{2c_p}$$

$$\frac{P_0}{P} = \left(\frac{T_0}{T}\right)^{\frac{k}{k-1}}$$

$$\frac{\rho_0}{\rho} = \left(\frac{T_0}{T}\right)^{\frac{1}{k-1}}$$

$$c = \sqrt{kRT}$$

$$\frac{T_0}{T} = 1 + \left(\frac{k-1}{2}\right)\mathrm{Ma}^2$$

$$\frac{P_0}{P} = \left[1 + \left(\frac{k-1}{2}\right)\mathrm{Ma}^2\right]^{\frac{k}{k-1}}$$

$$\frac{\rho_0}{\rho} = \left[1 + \left(\frac{k-1}{2}\right)\mathrm{Ma}^2\right]^{\frac{1}{k-1}}$$

$$\dot{m} = \rho AV = \left(\frac{P}{RT}\right)A\left(Ma\sqrt{kRT}\right) = PA\mathrm{Ma}\sqrt{\frac{k}{RT}}$$

$$\dot{m} = \frac{A\mathrm{Ma}P_0\sqrt{\frac{k}{RT_0}}}{\left[1 + (k-1)\frac{\mathrm{Ma}^2}{2}\right]^{\frac{(k+1)}{[2(k-1)]}}}$$