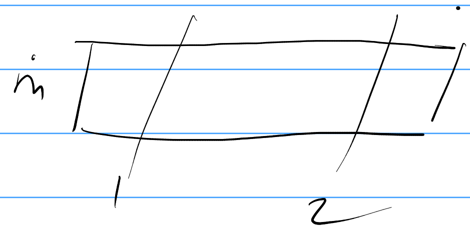
Rayleigh Flow

$$p + \rho V^2 = \text{const.}$$

$$\Rightarrow p(1+\gamma M^2) = \text{const}$$



$$p \propto \frac{1}{1+\gamma M^2}$$

$$\frac{P_2}{P_1} = \frac{1+\gamma M_1^2}{1+\gamma M_2^2} \quad — \text{(A)}$$

$$T = P/\rho R$$

Since $\rho A u = \dot{m}$

$$\rho = \frac{\dot{m}}{Au}$$

$$T = \frac{p\,Au}{\dot{m} R} =$$

$$\Rightarrow \sqrt{T} = (\text{const})\, pM \quad — \text{(B)}$$

from (A) & (B)

$$\frac{T_2}{T_1} = \frac{M_2^2}{M_1^2} \cdot \frac{(1+\gamma M_1^2)^2}{(1+\gamma M_2^2)^2}$$

$$\frac{\rho_2}{\rho_1} = f(M_1, M_2) \Rightarrow \frac{\rho_*}{\rho_1} = f(M_1, M_2 = 1)$$

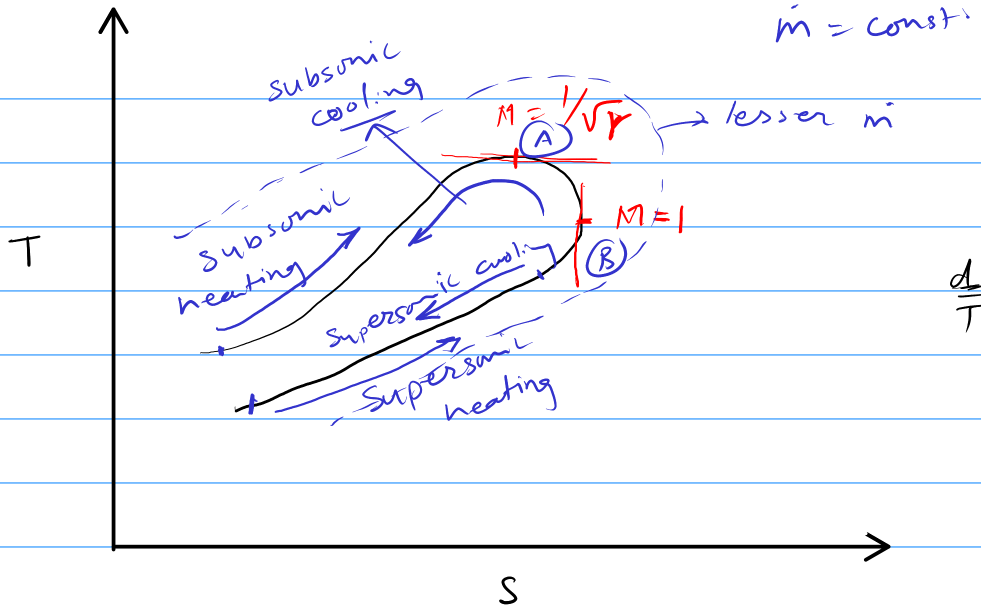
$$\frac{\rho_1}{\rho_*} = 1/f(M_1)$$

$$\frac{P_{0_2}}{P_{0_1}} =$$

$$\frac{T_{0_2}}{T_{0_1}} =$$

$$\frac{S_2 - S_1}{R} \Big/ \frac{S_2 - S_1}{C_p} = f(M_1, M_2)$$

$$\Rightarrow q = C_p(T_{0_2} - T_{0_1}) = h_{0_2} - h_{0_1}$$



$\dot{m} = $ const.

$$\frac{dT}{T} = (1 - \gamma M^2)\frac{du}{u}$$