

Initial Data Line for 2 - D M.O.C. "Running Method" Wall Expansion Section

$$\left(\frac{A}{A^*} \right)_{exit} \rightarrow M_{exit} \rightarrow \nu_{exit} = \sqrt{\frac{\gamma+1}{\gamma-1}} \tan^{-1} \sqrt{\frac{\gamma-1}{\gamma+1} (M_{exit}^2 - 1)} - \tan^{-1} \sqrt{(M_{exit}^2 - 1)}$$

$$\theta_{\max} = \frac{\nu_{exit}}{2} \Big|_{\substack{\text{min} \\ \text{length} \\ \text{nozzl}}}$$

for expansion section pick ... $\theta_{\max < \frac{\nu_{exit}}{2}}$

$$N = \# \text{ of grid characteristic lines} \rightarrow \Delta\theta = \frac{\theta_{\max}}{N} \rightarrow \theta_i = i \cdot \Delta\theta \quad i = 1, 2, 3, \dots, N$$

Wall Point Coordinates \rightarrow radius of curvature = $R_{c_{expansion}}$

$$X_i = R_{c_{expansion}} \sin(\theta_i)$$

$$Y_i = \frac{1}{2} D_{throat} + R_{c_{expansion}} [1 - \cos(\theta_i)]$$

$$\rightarrow \theta_i = i \cdot \Delta\theta \quad i = 1, 2, 3, \dots, N$$

Use Prandtl-Meyer expansion to calculate ν_i

$$\nu_{throat} = \theta_{throat} = 0 \rightarrow \nu_i = \nu_{throat} + \theta_i \rightarrow \nu_i = i \cdot \Delta\theta$$

$$\rightarrow i = 1, 2, 3, \dots, N$$

$$\nu_i = \sqrt{\frac{\gamma+1}{\gamma-1}} \tan^{-1} \sqrt{\frac{\gamma-1}{\gamma+1} (M_i^2 - 1)} - \tan^{-1} \sqrt{(M_i^2 - 1)}$$

Extract M_i from ν_i