

GATE Aerospace Engineering (AE) Gas Dynamics

ASSIGNMENT-3, OBLIQUE SHOCK-WAVES

1. A jet of air at Mach number of 2.5 is deflected inward at the corner of a curved wall. The wave angle at the corner is 60 degree.
 - a) Determine the deflection angle of the wall
 - b) Final Mach number

2. Observation of an oblique shock in air reveals that a Mach 2.2 flow at 550 K and 2 bar abs. is deflected by 14°. What are the conditions after the shock? Assume that the weak solution prevails.

3. A converging–diverging nozzle (Figure 1) with an area ratio of 5.9 is fed by air from a chamber with a stagnation pressure of 100 psia. Exhaust is to the atmosphere at 14.7 psia. Show that this nozzle is operating between the second and third critical points and determine the conditions after the first shock.

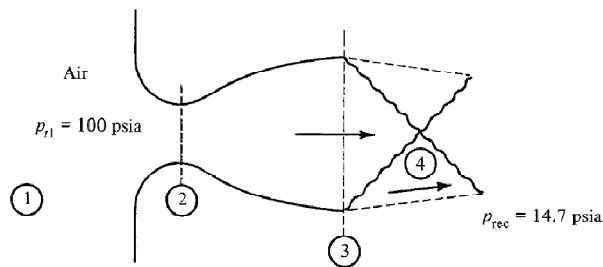


Figure 1

4. Air approaches a 27° conical diffuser at $M_1 = 3.0$ and $P_1 = 0.404$ psia. Find the conical-shock angle and the
5. Conditions before a shock are $T_1 = 40^\circ\text{C}$, $P_1 = 1.2$ bar, and $M_1 = 3.0$. An oblique shock is observed at 45° to the approaching air flow.
 - (a) Determine the Mach number and flow direction after the shock.
 - (b) What are the temperature and pressure after the shock?
 - (c) Is this a weak or a strong shock?

6. The supersonic flow of a gas ($\gamma = 1.4$) approaches a wedge with a half-angle of 24°
 - (a) What Mach number will put the shock on the verge of detaching?
 - (b) Is this value a minimum or a maximum?