ME 6135: Advanced Aerodynamics

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Lecture-14

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Oblique Shock Waves
Shock Wave Reflection

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Problem

(Anderson Ex. 9.6)

Consider a wedge with a 15◦ half angle in a Mach 5 flow, as sketched in Figure 9.17. Calculate the drag coefficient for this wedge. (Assume that the pressure over the base is equal to freestream static pressure, as shown in Figure 9.17.)

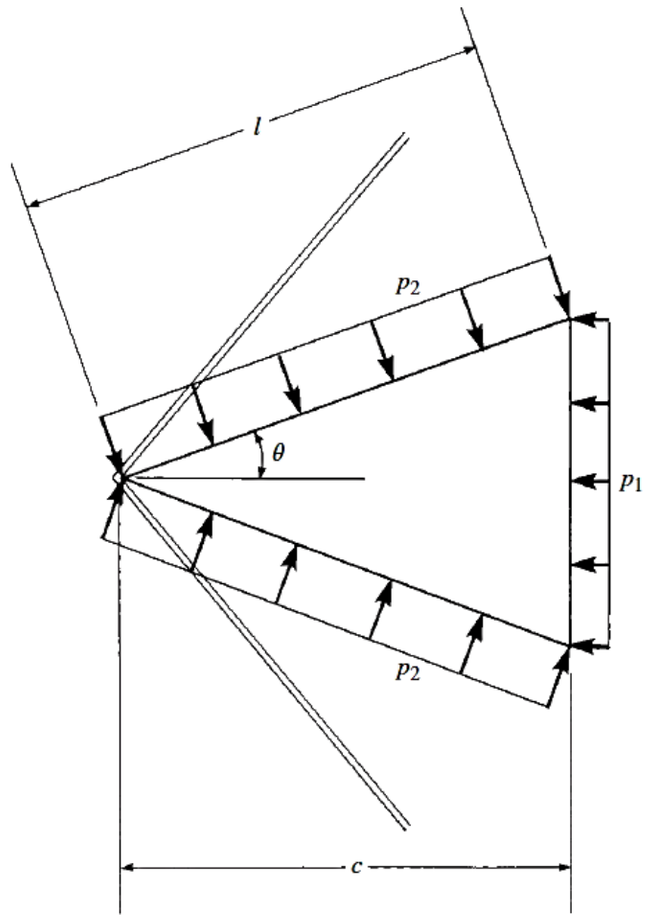


Figure 9.17 Illustration for Example 9.6.

Regular Reflection (RR)

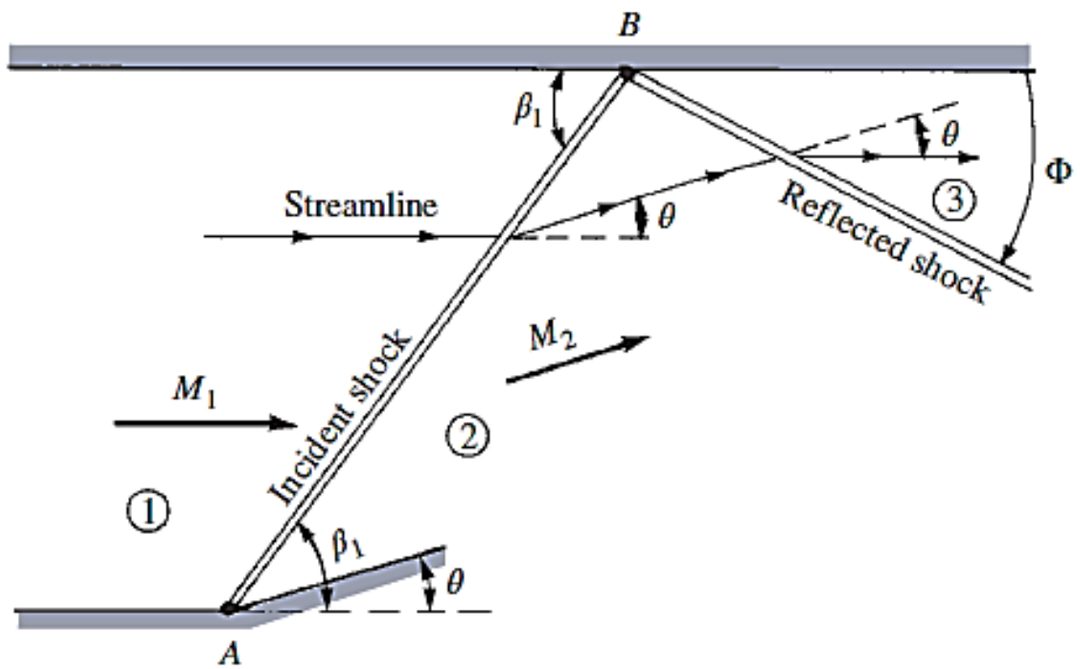
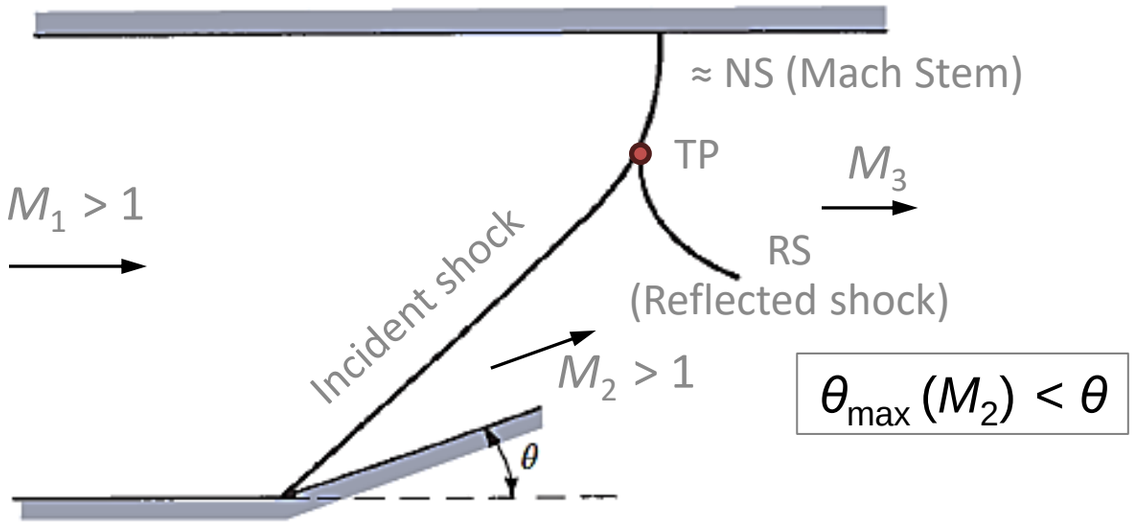


Figure 9.19 Regular reflection of a shock wave from a solid boundary.

Mach Reflection (MR)



$\theta_{max}(M_2) < \theta$

Figure 9.20 Mach reflection.

Problem

(Anderson Ex. 9.7)

Consider an oblique shock wave generated by a compression corner with a 10◦ deflection angle. The Mach number of the flow ahead of the corner is 3.6; the flow pressure and temperature are standard sea level conditions. The oblique shock wave subsequently impinges on a straight wall opposite the compression corner. The geometry for this flow is given in Figure 9.19. Calculate the angle of the reflected shock wave Φ relative to the straight wall. Also, obtain the pressure, temperature, and Mach number behind the reflected wave.

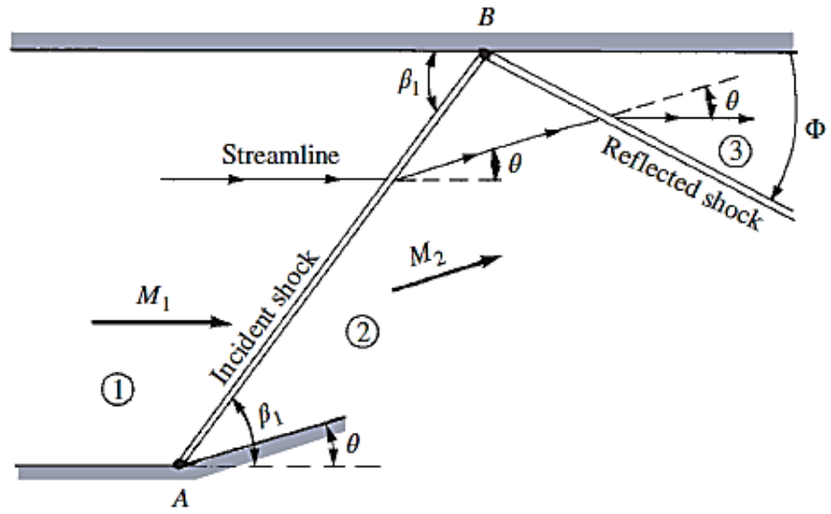


Figure 9.19 Regular reflection of a shock wave from a solid boundary.