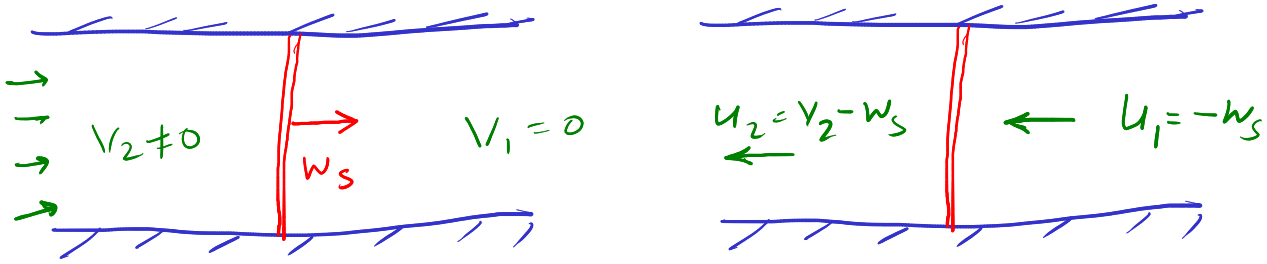
L12

Shock Reference frame



Q:- What happens to the thermodynamic quantities as I change the reference frame?

In the shock reference frame,

$$u_1 = M_1 a_1$$

Also, $\quad w_s = -u_1$

$$= -M_1 a_1$$

$$|w_s| = |M_1 a_1|$$

$$w_s = M_1 a_1$$

Now, $\quad \frac{P_2}{P_1} = 1 + \frac{2\gamma}{\gamma+1}(M_1^2 - 1)$

$$\Rightarrow M_1^2 = \frac{\gamma+1}{2\gamma}\left(\frac{P_2}{P_1} - 1\right) + 1$$

$$= \frac{\gamma+1}{2\gamma}\left(\frac{P_2}{P_1}\right) + \frac{\gamma-1}{2\gamma}$$

$$\therefore \quad w_s = a_1\left[\frac{\gamma+1}{2\gamma}\left(\frac{P_2}{P_1}\right) + \frac{\gamma-1}{2\gamma}\right]$$

If I have a weak shock, then

$P_2/P_1 \to 1$, then