Problem 11.2

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$$\frac{4fL^*}{D_H} = 0.336 = \frac{M_2^2 - 1}{4M_2^2} + \frac{1}{2}\ln\left[\frac{4(1+0.2M_2^2)}{M_2^2(1+0.2\cdot 4)}\right]$$

$$\boxed{M_2 = 1.3}$$

$$p_1 = p_0(1+0.2M_1^2)^{-3.5} = 10.22\ kPa$$

$$\frac{p_1}{p^*} = \frac{1}{M_1}\left[\frac{2+0.4M_1^2}{2.4}\right]^3 = 1.6875$$

$$\frac{p_2}{p^*} = \frac{1}{M_2}\left[\frac{2+0.4M_2^2}{2.4}\right]^3 = 1.0663$$

$$\boxed{p_2 = \frac{1.6875}{1.0663}\cdot p_1 = 16.17\ kPa}$$

$$T_1 = T_0(1+0.2M_1^2)^{-1} = 162.8\ K$$

$$\frac{T_1}{T^*} = \frac{2.4}{2+0.4M_1^2} = 0.667$$

$$\frac{T_2}{T^*} = \frac{2.4}{2+0.4M_2^2} = 0.896$$

$$\boxed{T_2 = \frac{0.896}{0.667}T_1 = 218.9\ K}$$

$$\frac{A}{A^*} = 3 = 0.5787\,\frac{(1+0.2M^2)^3}{M}$$

$$\boxed{M = 0.197}$$