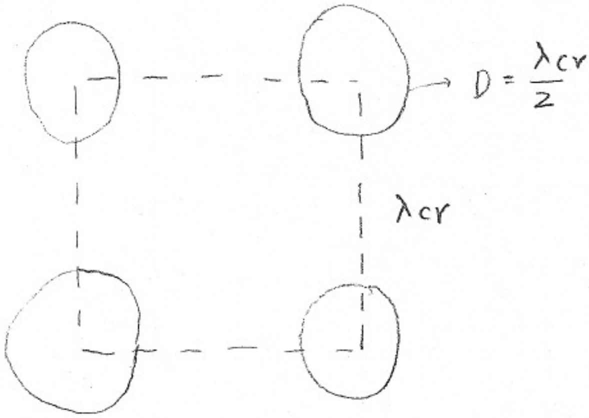

$\lambda_H = \lambda_C = 2\pi R_j \quad , \quad U_{G,cr} = \sqrt{\dfrac{2\pi\sigma}{\rho_G \lambda_H}}$

mass flow rate

$$\dot{m} = \rho_G A_G U_G$$

$$= \rho_G \frac{\pi}{4}\left(\frac{\lambda_{cr}}{2}\right)^2 \sqrt{\frac{2\pi\sigma}{\rho_G \lambda_H}}$$

$$\lambda_H = 2\pi\left(\frac{\lambda_c}{2}\right) = \pi\lambda_c$$

$$= \rho_G \frac{\pi}{4}\frac{1}{4}\lambda_c^2 \sqrt{\frac{2\pi\sigma}{\rho_G \lambda_c}}$$

$$= \frac{1}{16}\rho_G \pi \lambda_c^2 \sqrt{\frac{2\pi\sigma}{\rho_G \lambda_c}}$$

$$= \frac{1}{16}\rho_G \pi\, 4\pi^2 R_j^2 \sqrt{\frac{\sigma}{\rho_G R_j}}$$

OK

$$= \frac{1}{4}\rho_G \pi^3 R_j^2 \sqrt{\frac{\sigma}{\rho_G R_j}}$$

mass flow rate per unit surface area:

$$\frac{\rho_G \frac{1}{16}\pi \cdot \lambda_c^2 \sqrt{\frac{2\pi\sigma}{\rho_G \lambda_c}}}{\lambda_c^2} = \frac{1}{16}\rho_G \pi \sqrt{\frac{2\pi\sigma}{\rho_G \lambda_c}} = \frac{1}{16}\sqrt{\frac{2\pi^3\sigma\rho_G}{2\pi R_j}}$$

Numbers can now be plugged in

$$= \frac{1}{16}\sqrt{\frac{\pi\sigma\rho_G}{R_j}}$$