EN644 Two-Phase Flow and Heat Transfer
Assignment -5

1. Starting from the definition of the kinetic energy flux as:

   $\dot{m}\left(x v_g^{\,2} + (1-x) v_l^{\,2}\right)$,

   Show that for a given total mass flow, the kinetic energy flux will be minimum for the slip given by $s = \left(\frac{\rho_l}{\rho_g}\right)^{\frac{1}{3}}$.

2. Starting from the definition of the momentum flux as:

   $\dot{m}\left(x v_g + (1-x) v_l\right)$,

Show that for a given total mass flow, the momentum flux will be minimum for the slip given by $s = \left(\frac{\rho_l}{\rho_g}\right)^{\frac{1}{2}}$.

3.. Develop an Excel Sheet for the prediction of critical mass flux using Moody's model. You can use the computerised steam table supplied for the same. Get your results for a few p_0 and h_0 spanning the domain given in the original reference and compare your solution with it. Just modify it to predict the values using homogeneous model and Fauske's model. Compare the values for a system that is saturated at 70 bar

4. Starting from the length scale and velocity scale as discussed in class, and using the constants suggested, get the final form of
   (a) Rohsenow's correlation,
   (b) Forster and Zuber Correlation

5. Using the above correlations, compare the value of T_w-T_{sat} for a flat plate in a saturated pool of water at 1 bar with a heat flux, q'', equal to 10,100,1000 kW/m^2. Assume that the plate is of SS which is ground.

6. Subcooled water at 100 bar enters an evaporator tube of 1.3 cm diameter at 550 K. The tube wall temperature is maintained constant at 605 K. Estimate the mass flux at which the onset of nucleation just occurs at distance of 30 cm from the inlet. Use Davis and Anderson correlation for the estimation. If the mass flux is decreased below this level, does the boiling persist, or is it suppressed at that point.