MID EXAM
Two-Phase Thermal-Hydraulics

April 23, 2009

1. A vertical electrically heated tube, having a triangular axial heat flux distribution, is closed at the bottom and is connected at the top to a pool of liquid having a subcooling of 10 BTU/lbm. Derive an analytical expression for the maximum(axial) average heat flux which can be supplied to the tube without overheating, assuming that global CCFL flooding is the controlling mechanism. For this analysis, assume that the Wallis flooding correlation is valid.

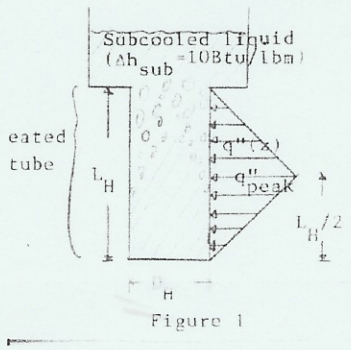

Figure 1

2. In a electrically heated tube of I.D. of 3 in., the uniform heat flux and the system pressure are 55.65 Btu/ft^2-sec and 1000 psia. The tube length is 12 ft.
   (a) Calculate the inlet flow velocity when the exit void fraction is 74%.
   (Assume the slip ratio and the coolant inlet enthalpy be 1.3 and 512 Btu/lbm, repectively.)
   (b) Calculate the void departure point using the Saha and Zuber correlation.
   (c) Calculate the wall temperature at 10 ft.

3. Answer followings with English;
   (1) show 3 examples of characteristics of two-phase system
   (2) micro-pumping
   (3) brief description of boiling process
   (4) show 3 examples of forces acted on bubble
   (5) isobaric bubble dynamics
   (6) Helmholtz instability
   (7) pressure effect on CHF
   (8) Leidenfrost point
   (9) 3 mechanism of boiling transition in subcooled and low quality region
   (10) Tong-F factor
   (11) show 2 examples to measure CHF
   (12) show 2 examples to measure the void fraction
   (13) flow quality
   (14) drift-flux parameters
   (15) virtual mass force