CHAPTER VI

CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

The conclusions from this work are as follows:

1. Two rectangular natural circulation loops have been designed and constructed for simulation of a two-phase flow under two different configurations.

2. At the same heating power level, the water temperature was much higher when the cooling system was turned off.

3. Regardless of the turning condition of the cooling system, the same temperature differences across the heater were measured.

4. The mass flow rate due to the density gradient was found to be increased with the increasing heating power level.

5. The amplitude of the initial fluctuation was found to increase as the heating power level was increased.

6. It was speculated that the temperature oscillation of water in the NCL#1 was due to the presence of the horizontal tube. In order to minimize the oscillation in the two-phase flow caused by this configuration, the horizontal tube should be minimized or eliminated.

7. The temperature oscillation of water in the NCL#2 was due to flow instabilities which were known as geysering and flashing-induced density wave oscillation.

8. The Fast Fourier Transform (FFT) was a good method to analyze the oscillation curve when it became more complex.

9. The frequency of the temperature oscillation at the heater outlet was found to be increased with the increasing heating power level for the NCL#1.

10. In the NCL#2, the effect from heat loss in the condenser caused the temperature oscillation frequency at the heater outlet to increase as the heat flux increased. The rate of increase became slower until saturation occurred at high heat flux.

11. The frequency of the temperature oscillation at the condenser outlet was found to increase when the heat flux was increased.

12. The frequency of the differential pressure oscillation matched the frequency of the temperature oscillation at the heater outlet for each and every value of heat flux used. Therefore, the oscillations of both differential pressure and the temperature at the heater outlet were driven by the boiling, which in turn was directly affected by the heat flux used in the experiment.

13. The TEXAS code was modified to simulate the two-phase flow in the rectangular natural circulation loop.

14. The results from the computer simulation agreed with the experimental results. However, the simulation had some limitation, and still required further modification.

5.2 Suggestions

The suggestions from this work are as follows:

1. There is uncertainty in the heating power measurement when a dimmer circuit is used to control the input power supply. To get more accuracy in the heating power measurement, a slide regulator should be used to control the input power supply.

2. As can be observed, the void fraction varied along the riser. Therefore, the void fraction measurement system should be developed to measure the void fraction from the heater outlet to the expansion tank.

3. The high speed video camera should be used to record the phenomenon during the transient startup.

4. A flow meter should be installed to measure flow rate in the loop.

5. The effect of surface roughness of the heater on boiling instability should be investigated in the future.

6. Effect of expansion tank and heat loss should be added to the computer simulation.

7. Constant heat flux value and position of heating section should be moved from heater.f to input.txt. Therefore, user can change any value without rebuild program.

8. Effect of mesh size should be studied in the future.