CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. A steady-state n-node liquid network simulator was developed. The program can be used to simulate the behavior of a pipeline, pump and channel system based on characteristics of pipe, pump and channel.

2. The simulator was divided into two parts. The first part is responsible for calculation of flow rates and pressures at all nodes, which are connected by pipeline segments or pumps. In the other part, the flow rates and depth of every channel can be determined by means of material balances and nodal elevations.

3. The simulator, which is runs on PC Pentium 133-MHz, RAM 32 M computer platform under the Windows 98 environment, took about 7 seconds to run a network of 37 nodes and 36 pipes shown in Fig. 4.1 and about 5 seconds for the example network shown in Fig 4.3.

The simulator performs satisfactorily for the case of pipes and pumps network. However, for the open channel system, the program needs to be improved since the results are not as good as for the pipe and pump system.

4. For a appropriate value of the damping factor, σ , we found that this value depends on the system (network). Some network, $\sigma = 1/5$ use the number of iteration more than $\sigma = 1/2$, but some network, $\sigma = 1/2$ use more than $\sigma = 1/5$. Thus, this program uses 1/3 for the value of σ.

6.2 Recommendations

1. The bandwidth, the maximum difference in adjacent nodal numbers, depends on the topological representation of the network. Thus, to reduce the calculating time, the user should assign the numbers of nodes, which have the minimum of difference in nodal numbers.

2. In order to improve the results of the open channel part, the assumptions should be adjusted close to the real cases. According to the assumption used for the case of flows in open channels are too ideal. Such as the assumption number 4, the flow type in every channel is a steady and uniform, it makes the results too far from the real data. Thus, the flow type in every channel should be assumed as a steady and varied (nonuniform) flow.

For the algorithm, because this program calculates the flow in an open channel according to the elevation of the connection node, the lower elevation channel will not affect to the higher one. Therefore, the algorithm should be changed to solve whole network simultaneously.

3. To solve the varied (nonuniform) flow, the user should separate every channel into 5-10 sections (depends on an accuracy that you want) and use the momentum and mass balance to link each section together. After all equations from the balance obtained, solve them simultaneously (see example 6-3, *Open Channel Flow* (Chaudhry, M. H., 1993)).

4. For the open channel network, the user should assign the nodal number according to the nodal elevation from high to low elevation.