

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

1. The correlation of the tested pilot-scale plate heat exchanger is as follow:

$$Nu = 0.02 Re^{0.87} Pr^{0.78}$$

It has a standard deviation equal to 0.081 compared to the experimental data. The Reynolds number in this work varies from 100 to 4,000 and the Prandtl numbers varies from 2.11 to 40. The studied pilot-scale plate heat exchanger is Eurocal 5 type as shown in Fig. 4.2. Its plate has a gap of 0.00313 m, width of 0.1125 m, length of 0.455 m, chevron corrugation (angle = 50 degrees), and surface area of 0.05 m². The exchanger tested has three sections, i.e. cooling, regenerative and heating sections. The regenerative section is composed of 37 plates, and the flow pattern is nine pass/nine pass. The heating section is composed of 10 plates, and the flow pattern is two pass/ two pass. The cooling section is composed of 13 plates, and the flow pattern is three pass/ three pass. In all three sections, the flow configuration is countercurrent, containing two channels per loop of each liquid, with the loops connected in series,

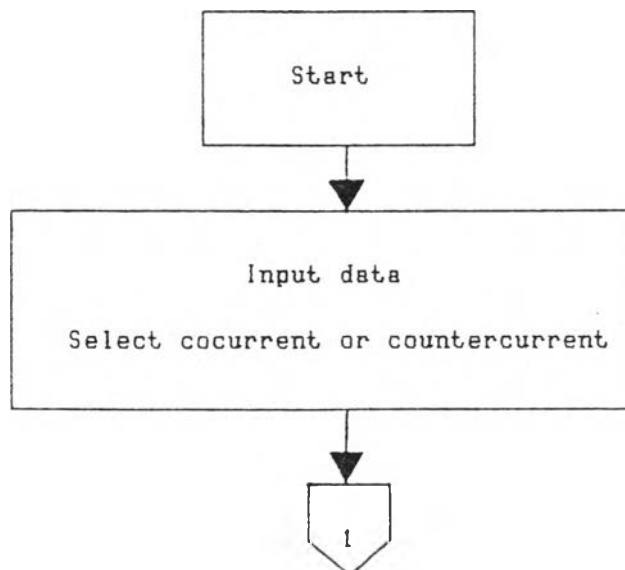
as presented in Fig. 4.3.

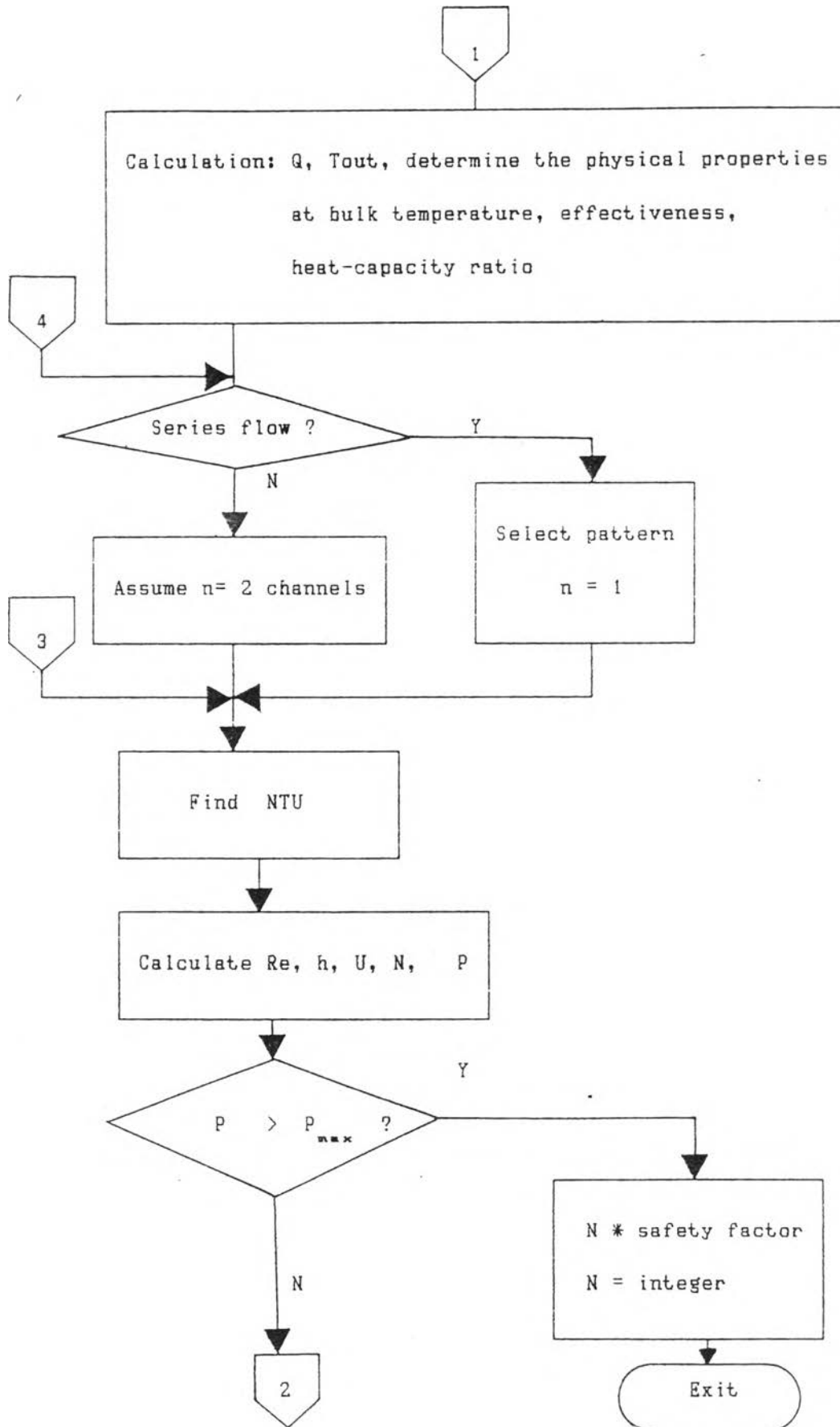
2. A computer program is developed to aid in the design of plate heat exchanger. It is written in the TURBO BASIC language and its subroutines contain the physical properties of the tested liquids in the range of 273 and 410 K. The heat transfer correlation of the plate heat exchanger obtained above is used and the characteristics of the plate above are set as default values. The Reynolds number should be in the turbulent region ($Re > 150$). The countercurrent flow configuration of two channels per loop of each liquid is the assumed flow pattern. The program gives design results that agree well with experimental results and conditions.

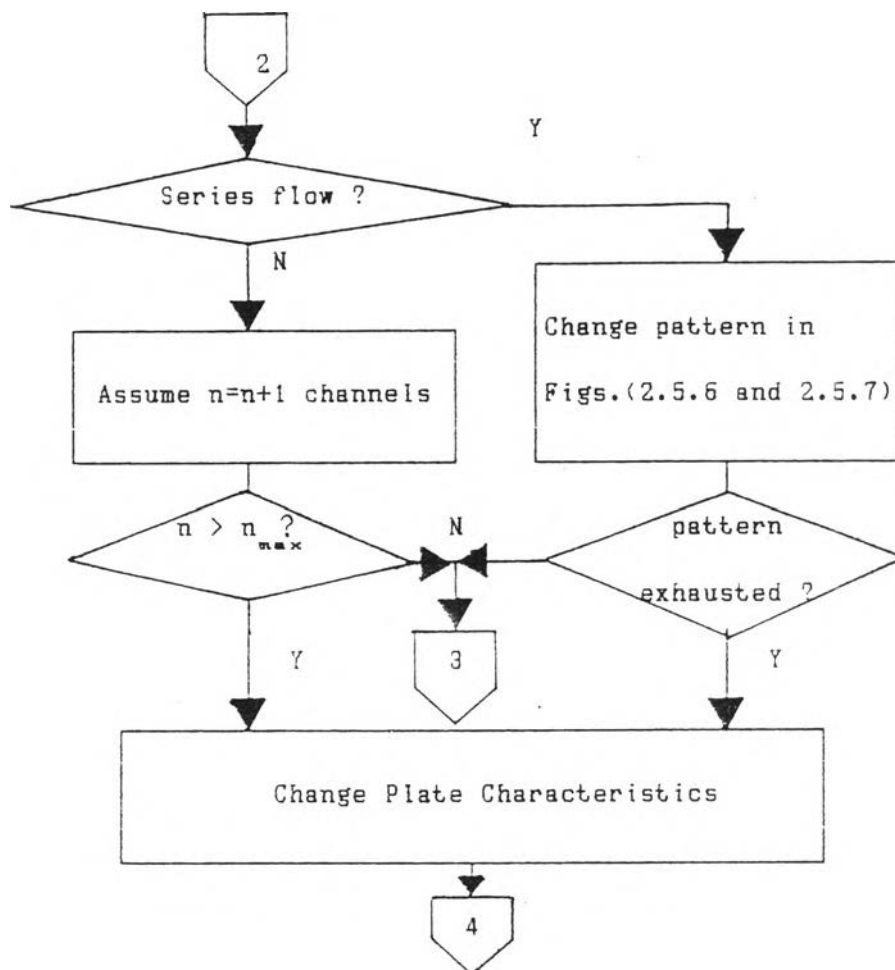
7.2 RECOMMENDATION

The above computer program may be expanded to cover all types of flow patterns and configurations by incorporating the appropriate E-NTU relationships (Figs. 2.5.4, 2.5.5, 2.5.6 and 2.5.7).

The flow chart of such an expanded program may be as follows:







Furthermore, more heat transfer correlations for different plate characteristics may be added to the program.