CHAPTER I
INTRODUCTION

One of the major costs to operate distillation unit is the energy cost. The energy can be supplied from external utility or by recovered heat. The energy consumption makes the efficient use of the energy as an important issue. The design of heat exchanger networks (HENS) for energy recovery will minimize the annualized cost of utility.

The methods can be considered for two major approaches, thermodynamic and mathematical methods. First, thermodynamic approach uses pinch technology to design heat exchanger network. It can be used to determine the minimum utilities required in the process. The good point of pinch is that the system information can be presented in simple diagrams like grand composite curves and used routinely in the large number of industrial company. In contrast, There are limitation inherent in pinch based method, such as the problem definition phase (hard to handle forbidden matches), the targeting phase (approximations and heuristic rules that fail), as well as the design and optimization phase (multiple tradeoffs). These limitations are the major factor to motivate the research on second method, mathematical programming.

Mathematical programming is a class of methods for solving constrained optimization problem. The mathematic modeling is lead to different types of formulation, such as Linear Programming (LP), Mixed Integer Linear Programming (MILP), Non-Linear Programming (NLP), Mixed Integer Non-Linear Programming (MINLP) models. Mathematical programming can be divided into three steps. First, of them is modeling phase, including analysis of problem, constructing the model and completing input the data. Second is finding optimal solution of the model and the last one is the analysis of the result and implementation. The formulation and solution of major types of mathematical programming problem can be effectively performed with modeling system such as GAMs (Brooka et al., 1992)

GAMs (General Algebraic Modeling System) is a modeling system for optimization that provides on interface with variety of different algorithms and specifically design for modeling linear, non-linear and mixed integer optimization problems. For retrofitting, GAMS can be used to optimize process to enhance both ener-

gies an input file in the form of algebraic equation which is higher level language. GAMS compile the model and interfaces automatically with the solver. The model is compiled to get a solution and it is reported to the user with output file.

The major development of mathematical programming concerned in rigorous targets for heat integration is the use of the heat cascade to formulate Transshipment Models. New rigorous one-step MILP formulation for heat exchanger network synthesis was developed by Barbaro and Bagajewicz (2002) to design and retrofit of heat exchanger network. The rigorous targets can be obtained for energy requirement, number of unit, heat transfer area, even in case where there are restrictions on matches.

The objectives of this research can be divided into two parts. Firstly, heat exchanger network design and retrofit model with uncertainty constraint will be developed. And the next step, applying the program to minimize cost of utilities will be applied to ARC refinery and the heat exchanger network will be simulated by SIMSCI (ProII) software to make sure that the heat exchanger network is possible. The annual cost of the heat exchanger network will be compared between old and new design.