CHAPTER I
INTRODUCTION

Recently, energy consumption in existing or new process industries tends to increase sharply and renewable energy is still too expensive to use completely. Therefore, energy recovery by heat integration is one of the main tasks to reduce energy consumption and improve the performance of heat exchanger network (HEN). The optimization method is introduced to systemically design HENs. The HENs synthesis and retrofit are addressed as the HEN design problems. To overcome HEN design problem, the methods accomplished with thermodynamic approaches via pinch technology (PT) or mathematical programming (MP) approaches are applied. The former approach has been widely used in industry due to their insight based method in calculation procedures in energy targets and HEN design. However, PT approaches do not guarantee an optimal solution or even a near-optimal one. This research, therefore, focuses on the mathematical modeling and optimization for HEN design.

There are two well-known classes of methods for HENS, simultaneous synthesis and sequential synthesis approaches. The former optimizes HEN using trade-offs between operating costs and capital costs at once, thus giving better design than the other. To avoid nonlinear terms in formulation and simplify model, the isothermal mixing assumption is introduced. However, as Yee and Grossmann (1990) explained, the isothermal mixing may lead to an overestimation of the area cost. Most simultaneous approaches usually have mixed-integer nonlinear programming (MINLP) formulations raising some solving difficulties by high model complexity and computational time.

This work is divided into two main parts, which are, HEN synthesis and retrofit. Assumption of isothermal and non-isothermal mixing are considered in both parts. Therefore, the objectives of this research are to design firstly HEN with/without isothermal mixing assumption by MINLP formulation and to retrofit the existing HEN under not only isothermal mixing assumption but also non-isothermal mixing one.