بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

Suez Canal University
Faculty of Petroleum and Mining Engineering
Chemical and Refining Engineering
Department

New Approach for Heat Exchanger Networks Design

Thesis
Submitted for partial fulfillment of
M.Sc. in
Chemical Engineering and Petroleum Refining

Eng./ ABEER MAHMOUD SHAIB

UNDER THE SUPERVISION OF

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2002

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New Approach for Heat Exchanger Networks Design

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By

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Approval Committee

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ABSTRACT

The problem of heat exchanger network synthesis (HENS) has received a considerable attention over the last twenty years. An important feature of heat exchanger network design is the energy-capital trade-off. This trade-off has been regarded as complex due to the number of structural networks usually available, each being subject to continuous optimization. The disadvantage of this approach is that optimality is local to the structures examined.

Alternatively, mathematical programming can be used but user interaction with the solution is more complicated and generally performed at higher levels in the problem formulation rather than in the design. So, until now, no generalized technique has been introduced for the prediction of global optimum cost networks that allow user interaction with the network structure.

However, a number of works has been published turning attention to the thermodynamic analysis which yields key points and interrelations (the pinch point and composite curves) as well as the design targets (maximum heat recovery, minimum area of units).

The present study is divided into two parts. The objective of the first part is to create heat exchanger network systems using different procedures forming the optimal synthesis of HENs. The system (hot and cold streams) is described to the heat exchanger parameters (supply temperature, target temperature and heat capacity flow rate of each stream) and economic parameters (prices of equipment, heating steam and cooling water).

Two procedures are used in the present study. The first proposed procedure is based on the Mcp_H/Mcp_C heuristic, in which the highest heat capacity of the hot stream is matched with the highest heat capacity of the

cold stream, regardless to temperatures. The second procedure is based on the H/H heuristic, the hot stream having the highest inlet temperature is matched with the cold stream having the highest outlet temperature.

Three techniques were used to differentiate between the results obtained:

1- Evaluating the index of structural controllability of a process by examining the modes or patterns of disturbance propagation and the control precision of each output variables through the process.

2- The applicability of the exergy loss (deviation from the second low of thermodynamics) for studies of heat exchanger network processes. The concept of exergy provides an estimate of the minimum theoretical resource requirement (energy) of a process. This in turn provides information on the maximum saving.

3- Using multi-criteria methods of evaluation to reflect the multi-dimensional character of the firms performance.

The result expected from a multi-criteria inter-firm comparison is a cardinal or ordinal ranking of the firms based on their performances with respect to the ratio included in the analysis.

The objective of the second part of the study is to modify existing heat exchanger networks using pinch technology, to achieve the set targets.

The targeting procedure is based on energy and area targets as well as on the concept of area efficiency. An investment vs. savings plot is used to obtain a target for retrofit design.

Three heat exchange network systems were used as different case studies. The first system was chosen from "heat exchanger network synthesis" book by Shenoy. The second system was synthesized by Linnhoff, where the third system is a practical heat exchanger network for Aromatic plant, first presented in the IchemE and subsequently used by