ANALYSIS OF BILINEAR DISTILLATION COLUMN USING TUBULAR MODEL

By

NORAZLIN BINTI IBRAHIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

September 2004

DEDICATION

To my beloved husband, Mohd Tukiran Bin Mawi, my parents, my daughters Norizzah, Norinsyirah and Norathiliah, families and friend.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

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Chairman : Samsul Bahri Mohd Noor, PhD
Faculty : Engineering

All studies on distillation columns aim at improving the process so that it can be run effectively and efficiently to yield better quality product with lower energy consumption. A good working model is needed as a basis for controller design.

Tubular Columns means a column represented by a spatially distributed model. It has been modeled using Partial Differential Equation numerically. The advantage of using Partial Differential Equation is that it can analyze more than one independent variable and produce the output in a natural way. Numerically, the solution that has been used in this study is *pdepe* command line function on the Tubular columns model for rectifier and stripper section.

A continuous spatially distributed Tubular equations had been derived and validated using *pdepe* function in two space dimension h' and τ. It depends on the sensitivity of right boundary condition, and two parameters α and h'. The open loop and closed loop test is done throughout this study, shows the comprehensively output of composition and separation. The Tubular model now, is ready to be applied on any type of control method.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

ANALISA TERHADAP 'BILINEAR DISTILLATION COLUMN' MENGGUNAKAN MODEL TUBULAR

Oleh

NORAZLIN IBRAHIM

September 2004

Pengerusi : Samsul Bahari Mohd Noor, PhD

Fakulti : Kejuruteraan

Kesemua kajian dalam *distillation column* adalah bagi memperbaiki proses *distillation column* supaya ia boleh digunakan secara efektif dan berkesan dengan menggunakan tenaga yang rendah. Oleh itu model yang baik bagi *Distillation column* diperlukan.

Tubular Column bermakna lajur yang menggunakan konsep penyebaran secara khusus. Ia telah dimodelkan menggunakan *Partial Differential Equation*. Simulasi terhadap *Tubular columns* bagi bahagian *stripper* dan *rectifier* telah menggunakan pakej fungsi *pdepe*.

Model Tubular telah dihasilkan dan disahkan menggunakan fungsi *pdepe* berdasarkan dua pemalar h' dan τ yang saling bergantungan. Ia juga berdasarkan kepada pemilihan sempadan kanan(qr) dan dua parameter α dan h'. Pengujian *open loop* dan *closed loop test* dilakukan di dalam tesis ini. Hasilnya adalah komprehensif. Oleh itu, Model Tubular sudah sedia untuk diaplikasikan menggunakan mana-mana bentuk kawalan.

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I certify that an Examination Committee met on _____ to conduct the final examination of Norazlin bte Ibrahim on her Master Science thesis entitled Analysis of Bilinear Distillation Column in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirements for the degree of Master Science.The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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NORAZLIN BT IBRAHIM

Date : 5 OCTOBER 2004

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