

แนวทางในการเลือกตัวแปรเจเนติกสำหรับปัญหาออปติไมเซชันแบบหลายวัตถุประสงค์และ  
การประยุกต์สำหรับการสังเคราะห์กระบวนการนำกลับฟีนอล



นายปกรณ์ พรหมอ่อน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต  
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Guideline for Selection Genetic Parameters in Multi-objective Optimization Problem  
and Application for Synthesis Phenol Recovery Process

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A Thesis Submitted in Partial Fulfillment of the Requirements  
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Department of Chemical Engineering

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ปกรณัม พรหมอ่อน: แนวทางในการเลือกตัวแปรเจเนติกสำหรับปัญหาอพติไมเซชันแบบหลายวัตถุประสงค์และการประยุกต์สำหรับการสังเคราะห์กระบวนการนำกลับฟีนอล (Guideline for Selection Genetic Parameters in Multi-objective Optimization Problem and Application for Synthesis Phenol Recovery Process) อ.ที่ปรึกษา:อ.ดร.สุรเทพ เทียวหอม, 140 หน้า.

ปัญหาวิศวกรรมในอุตสาหกรรมเคมีโดยทั่วไปแล้ว มักเกี่ยวข้องกับการแก้ปัญหาอพติไมเซชันแบบหลายวัตถุประสงค์ซึ่งมีความขัดแย้งกัน และมีลักษณะของฟังก์ชันที่สลับซับซ้อน ปัญหาในลักษณะนี้เป็นปัญหาที่ยากในการหาคำตอบ และคำตอบที่ได้อาจเป็นคำตอบไม่แท้จริง ดังนั้น วิธีการอพติไมเซชันในการแก้ปัญหาที่มีความยุ่งยากทั้งสองนี้จึงมีความสำคัญอย่างยิ่ง อีโวลูชันนารี อัลกอริทึมคือวิธีการอพติไมเซชันที่นิยมนำมาใช้แก้ปัญหาดังกล่าว เนื่องจากเป็นอัลกอริทึมที่สามารถแก้ปัญหาอพติไมเซชันแบบหลายวัตถุประสงค์ที่มีความสลับซับซ้อนของตัวแปรได้อย่างมีประสิทธิภาพ อย่างไรก็ตาม อีโวลูชันนารี อัลกอริทึมมีข้อด้อยคือ มีพารามิเตอร์ควบคุมค่อนข้างมาก และ ค่าพารามิเตอร์ดังกล่าวมีความสำคัญต่อคุณภาพและความถูกต้องของคำตอบที่ได้

ในงานวิจัยนี้เราศึกษาผลกระทบของตัวแปรเจเนติก (อัตราการครอสโอเวอร์ และ อัตราการมิวเตชัน) ที่ใช้ในอีโวลูชันนารี อัลกอริทึม สำหรับปัญหาอพติไมเซชันแบบหลายวัตถุประสงค์ ซึ่งในงานวิจัยนี้ ทำการศึกษาตัวแปรเจเนติกสำหรับ MOGA, NSGA, NPGA, NSGA-II และ SPEA ทั้งนี้ แนวทางในการเลือกใช้ค่าตัวแปรเจเนติกที่เหมาะสม สำหรับปัญหาอพติไมเซชันแบบหลายวัตถุประสงค์ ได้ถูกพัฒนาขึ้น รวมทั้งนำแนวทางในการเลือกใช้ค่าตัวแปรเจเนติก ที่พัฒนาขึ้นได้ไปประยุกต์ใช้กับ ปัญหาการสังเคราะห์กระบวนการนำกลับฟีนอล เพื่อออกแบบกระบวนการและหาจุดดำเนินการที่ดีที่สุดซึ่งมีต้นทุนทางเศรษฐศาสตร์ต่ำสุด และมีผลกระทบต่อสิ่งแวดล้อมน้อยที่สุด จากผลการทดลองพบว่าแนวทางในการเลือกใช้ค่าตัวแปรเจเนติกที่พัฒนาขึ้น สามารถนำไปประยุกต์ใช้ในแก้ปัญหาการสังเคราะห์กระบวนการนำกลับฟีนอลได้อย่างมีประสิทธิภาพ

ภาควิชา.....วิศวกรรมเคมี.....ลายมือชื่อนิสิต.....  
 สาขาวิชา.....วิศวกรรมเคมี.....ลายมือชื่ออาจารย์ที่ปรึกษา.....  
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# # 47703349021: MAJOR CHEMICAL ENGINEERING

KEY WORD: EVOLUTIONARY ALGORITHMS/ MULTI-OBJECTIVE OPTIMIZATION PROBLEMS

PAKORN PROM-ON: GUIDELINE FOR SELECTION GENETIC PARAMETERS IN MULTI-OBJECTIVE OPTIMIZATION PROBLEM AND APPLICATION FOR SYNTHESIS PHENOL RECOVERY PROCESS. THESIS ADVISOR: SOORATHEP KHEAWHOM, Ph.D., 140 pp.

Many real-world chemical industrial problems involve two types of problem difficulty: i) multiple conflicting objectives (Multi-objective optimization) and ii) a highly complex search space. Thus, efficient optimization strategies being capable of solving problems with both types of problem difficulty are important. Evolutionary algorithm (EA) can efficiently solve multi-objective optimization problem with highly complex search space. Unfortunately, EA requires many parameters. Consequently, the selection of the parameters value is important, and has an effect on accuracy and convergence of the solution obtained.

This research focuses on analyzing the effect of genetic parameters (mutation and crossover probability) in evolutionary algorithm for multi-objective optimization problems. In this work, genetic parameters for MOGA, NSGA, NPGA, NSGA-II and SPEA are investigated. Furthermore, the generic guideline to select suitable parameters values for the multi-objective evolutionary algorithms is developed and applied in a case study. The case study involves the problem of synthesis of phenol recovery process. The objective of this problem is to find the suitable operating points providing a minimum total cost and minimum environmental impact. The generic guideline for selection appropriate genetic parameters is successfully applied to the case study.

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Academic year .....2006.....

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