

การลปรีมาณการคำนวณเฟลชของกาชธรมชาติโดยอาศัยองคประกอบตัวแทน



นางสาวตองจิตร ลีสัมบุรณ

วิทยานพนธนี้เป็นส่วนหนึ่ของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต

ภาควิชาวิศวกรรมเคมี

บัณฑิตวิทยาลัย จุฬาลงกรณมหาวิทยาลัย

พ.ศ. 2529

ISBN 974-566-165-1

013691

I1669b818

SCALING DOWN OF FLASH CALCULATIONS OF NATURAL GAS  
WITH THE AID OF PSEUDOCOMPONENTS

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A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Engineering

Department of Chemical Engineering

Graduate School

Chulalongkorn University

1986



Thesis Title    Scaling Down of Flash Calculations of Natural Gas with  
                     the Aid of Pseudocomponents

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 ชื่อนิสิต                      นางสาว ตองจิตร ลิ้มสมบูรณ์  
 อาจารย์ที่ปรึกษา        รองศาสตราจารย์ ดร. เกริกชัย สุภานุจน์  
 ภาควิชา                      วิศวกรรมเคมี  
 ปีการศึกษา                2528

บทคัดย่อ

การทำนายสมมูลย์ไอ-ของเหลวของกาซธรรมชาติจะเกี่ยวข้องกับการหาค่าคงที่สมมูลย์  
 ด้วยสมการสภาวะซึ่งในที่นี้เลือกใช้สมการสภาวะของ Soave-Redlich-Kwong และการหาค่า  
 องค์ประกอบในเฟสไอและของเหลวโดยวิธีเฟลช การคำนวณมักจะเป็นการคำนวณแบบ iterative  
 หรือ trial and error จึงต้องใช้คอมพิวเตอร์ช่วยในการคำนวณ เนื่องจากองค์ประกอบใน  
 กาซธรรมชาติมีมากทำให้สิ้นเปลืองเวลาการคำนวณ เพื่อเป็นการประหยัดเวลาการคำนวณจึงได้  
 เสนอแบบจำลองที่อาศัยองค์ประกอบตัวแทนมาช่วย แบบจำลองนี้สามารถลดเวลาการคำนวณลงได้  
 32% ของเวลาการคำนวณแบบธรรมดาและมีเปอร์เซ็นต์ความผิดพลาดอยู่ในช่วง 0.6 ถึง 3.1  
 แบบจำลองนี้ใช้กับระบบความดันต่ำและปานกลาง สำหรับช่วงความดันและอุณหภูมิที่ทำการศึกษาคือ  
 150.0 psia ถึง 1115.0 psia และ -8.0°F ถึง 50.0°F

ศูนย์วิทยทรัพยากร  
 จุฬาลงกรณ์มหาวิทยาลัย

Thesis Title     Scaling Down of Flash Calculations of Natural Gas  
                      with the Aid of Pseudocomponents  
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#### ABSTRACT

The prediction of vapor-liquid equilibrium of natural gas deals with the calculation equilibrium K values based on the Soave-Redlich-Kwong equation of state and the phase compositions by flash calculations. Service of a computer is required due to the iterative nature of the calculation. Because of many equations to be solved simultaneously, much computing time is required. Therefore, in this work, the pseudocomponents model was introduced to scale down the computing time. With this model, the computing time was saved to 32% of the ordinary method. The percentage average deviation was the range of 0.6 to 3.1. This proposed model was tested at low and moderate pressure ranging from 150.0 psia to 1115.0 psia and a temperature range of  $-8.0^{\circ}\text{F}$  to  $50.0^{\circ}\text{F}$ .



## ACKNOWLEDGEMENT

The author wishes to express her deepest gratitude to Associate Professor Dr. Kroekchai Sukanjanajtee, her advisor, for his most helpful and invaluable advice throughout the course of this study. Thanks are also extended to Mr. Pholchom Chanurai for the graphic works. The author is also in debt to Mr. Vichit Suthisripok for his help.



ศูนย์วิทยทรัพยากร  
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## NOMENCLATURES



- A : Parameter in the SRK equation of state
- $ac_i$  : Parameter in the SRK equation of state
- $(ac\alpha)$  : Parameter in the SRK equation of state
- B : Parameter in the SRK equation of state
- b : Parameter in the SRK equation of state
- F : Degree of Freedom
- $f_1$  : Fugacity of component i
- G : Gibb's Free Energy
- $K_1$  : Equilibrium K values of component i
- $k_{ij}$  : Binary interaction parameter
- L : Liquid flow rate, Liquid phase
- M : Subscript for the lightest component in the heavy pseudocomponent
- $m_1$  : Parameter of the SRK equation of state
- N : The total number of component
- P : Total pressure
- $P_i$  : Vapor pressure (saturation pressure of a pure species)
- $PC_i$  : Critical pressure of component 1
- $PR_i$  : Reduced pressure =  $P/PC_i$
- Q : Parameter in the SRK equation of state
- R : Universal gasconstant
- T : Temperature
- $TB_i$  : The normal boiling point of component i
- $TC_i$  : Critical temperature of component i
- $TR_i$  : Reduced temperature =  $T/TC_i$

- $x_1$  : The liquid phase composition, the first approximation of root
- $y_1$  : The vapor phase composition
- $Z$  : Compressibility factor
- $z_1$  : Feed composition

## GREEK LETTERS

- $\alpha$  : Parameter in The SRK equation of state
- $\beta$  : Parameter in BWRS equation of state
- $\gamma$  : Parameter in BWRS equation of state
- $\rho$  : Density
- $\Delta$  : Difference operator
- $\epsilon$  : Convergerge tolerance
- $\mu$  : Chemical Potential
- $\Phi$  : Fugacity Coefficient of a component in a mixture
- $\omega$  : Acentric factor
- $\Omega$  : Parameter in the SRK equation of state

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