Project

Reference

1. Naphtali, Leonard M., and Donald P. Sandholm. "Multicomponent separation calculations by linearization." AIChE Journal 17.1 (1971): 148-153.

Problem

1. In this exercise we will simulate a multicomponent distillation column using Naphtali and Sandholm Newton-Raphson algorithm. Write a code in Matlab to simulate the following system.

Components	Fz_i
Methanol	10 kmol/h
Acetone	30 kmol/h
Methyl Acetate	5 kmol/h
Benzene	20 kmol/h
Chloroform	20 kmol/h
Type of Column	Conventional with partial reboiler
Column pressure	1 atm
Feed plate location	7
Number of plates inside column	17
Thermal condition of Feed	Liquid at 330 K
Type of Condenser	Total
Reflux ratio	9.5
Bottom flow rate	62 kmol/h

Perform a degree of freedom analysis to determine if the information is sufficient to solve simultaneous non-linear equations. If not assume the required number of parameters. Compute composition on each tray (including bottom and distillate). Plot the temperature profile inside the distillation column. Use activity coefficients approach for the VLE with activity coefficient parameters given by Wilson's equation and fugacity coefficients computed from Redlich-Kwong equation of state. Compute the non-ideal enthalpies using enthalpy departure functions. Pure component properties can be obtained from Perry's Handbook or NIST database. Wilson's parameters (A_{ij}) to compute activity coefficients are given below. In this table, methanol is indexed as '1', acetone as '2', methyl acetate as '3', benzene as '4', and chloroform as '5'. The units are cal/gmol.

Component	1	2	3	4	5
1	0.0	6.6429×10^2	8.34583×10^2	1.67946×10^3	1.70257×10^3
2	-2.1501×10^2	0.0	-6.5210×10^1	4.949199×10^2	-7.3150×10^1
3	-9.8420×10^1	1.6126×10^2	0.0	1.01700×10^1	7.91000×10^1
4	2.1613×10^2	-1.6790×10^2	2.0054×10^2	0.0	1.4844×10^2
5	-3.7225×10^2	-3.1310×10^2	-4.3141×10^2	-2.0850×10^2	0.0

2. Check your results obtained from Matlab by performing rigorous simulation in ASPEN. If there are discrepancies.