TP (1°) Simulateurs de procédés L3 GP 2021/2022

In the first part of this chapter, we opened it with how to start HYSYS and get familiar with its desktop environment. We also discussed how to select components that will be used in simulation. Selecting the right fluid/thermodynamic package is very important and therefore we provided a flowchart that will assist users to select the right thermodynamics models.

The second part of this chapter was about how to enter and re-enter the simulation environment, and get familiar with simulation flow-sheet. In this part, users are also informed some important features of HYSYS.

The last part of this chapter was dealing with how to add and specify material streams for simulation. Variables specification is one of the important steps that users need to understand when dealing with HYSYS. When users wanted to specify streams especially materials, they need to specify at least four variables in order to have HYSYS to calculate the remaining properties.

Problems

1. Create one materials stream that contains only water with following conditions:

- Fluid Package: Peng-Robinson
- Flow-rate: 100 kg. mole/h
- Pressure: 1 atm
- Vapor/Phase Fraction: 1.00

What is the temperature of this stream in (°C)? _____

2. Repeat the above procedures by replacing pressure with temperature of 150°C.

What is the pressure of this stream? _____

3. With the same condition in (2), reduce the temperature to 70°C.

What is the new pressure of this stream? _____

4. Create one new materials stream that contains only water with following conditions:

- Fluid Package: Peng-Robinson
- Flowrate: 100 kg.mole/h
- Pressure: 2 atm
- Vapor/Phase Fraction:1.00

What is the temperature of this stream? _____

5. With the same condition in (4), increase the pressure to 5 atm.

What is the new temperature of this stream? _____

6. With the same condition in (4), decrease the pressure to 0.5 atm.

What is the new temperature of this stream? _____

7. What can you conclude from these problems (1-6)?

_____

_____

TP (2°) Simulateurs de procédés L3 GP 2021/2022

EQUATION OF STATE

Problems

1) Find the molar volume of ammonia gas at 56 atm and 450 K using Soave-Redlich-Kwong (SRK) equation of state.
2) Find the molar volume of methanol gas at 100 atm and 300 °C using Peng-Robinson (PR) equation of state. Compare its molar volume when you are using Soave-Redlich-Kwong (SRK) equation of state.
3) Consider the following mixture going into a Water-Gas-Shift reactor to make hydrogen for the hydrogen economy. CO, 630 kmol/h; H_2O, 1130 kmol/h; CO_2, 189 kmol/h; H_2, 63 kmol/h. The gas is at 1 atm and 500 K. Compute the specific volume of this mixture using Soave-Redlich-Kwong (SRK) equation of state.
4) Consider a mixture of 25 percent ammonia, and the rest nitrogen and hydrogen in a 1:3 ratio. The gas is at 270 atm and 550 K. Use Peng-Robinson (PR) equation of state to compute the specific volume of this mixture.
5) Consider the following mixture that is coming out of a methanol reactor: CO, 100 kmol/h; H_2, 200 kmol/h; methanol, 100 kmol/h. The gas is at 100 atm and 300 °C. Compute the specific volume using Soave-Redlich-Kwong (SRK) equation of state and compare it with Peng-Robinson (PR) equation of state.

TP (3°) Simulateurs de procédés L3 GP 2021/2022

Pump

This chapter begins with a problem to find the pump outlet temperature when given the pump efficiency. The user will operate a pump operation in HYSYS to model the pumping process. The user will learn how to connect streams to unit operations such as pump. At the end of this chapter, the user will determine the pump outlet temperature when given pump efficiency or vice versa.

The Pump operation is used to increase the pressure of an inlet liquid stream. Depending on the information specified, the Pump calculates either an unknown pressure, temperature or pump efficiency.

Learning Outcomes: At the end of this chapter, the user will be able to:

- Operate a pump operation in HYSYS to model the pumping process.
- Connect streams to unit operations.
- Determine the pump efficiency and outlet temperature.

Problem Statement

Pumps are used to move liquids. The pump increases the pressure of the liquid. Water at 120oC and 3 bar is fed into a pump that has only 10% efficiency. The flow-rate of the water is 100 kgmole/h and its outlet pressure from the pump is 84 bar. Using Peng-Robinson equation of state as a fluid package, determine the outlet temperature of the water.