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CHE364 - RESEARCH PROJECT

RESEARCH PROJECT TECHNICAL REPORT

IMPLEMENTATION OF DWSIM SIMULATOR AND ITS EFFECTIVENESS AS ALTERNATIVE SIMULATION SOFTWARE FOR CHEMICAL ENGINEERING STUDENTS

SUPERVISOR'S NAME: ENCIK AZMI BIN MAHMOOD

NAME	STUDENT ID
MUHAMMAD AZRI BIN KHASHIM	2018431302
DINA EDRYANA BINTI AZIAN ROHAIDI	2018273694
MADIHAH BINTI ABD RAUF	2018421632
NOR FARISHA MASTURA BINTI FISSOL	2018212824

Table of Contents

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Sir Azmi Bin Mahmood, Muhammad Azri Bin Khashim, Dina Edryana Binti Azian Rohaidi, Madihah Binti Abd Rauf, Nor Farisha Mastura Binti Fissol

Abstract

Computer simulation makes an important contribution in chemical process design. Currently, there are many types of commercial software that are available in the market for simulation of chemical processes such as Aspen HYSYS and Aspen Plus. However, these commercial software are expensive and their license need to be renewed every year that might put a financial pressure especially on institutions or universities with tight budget constraints. Due to this situation, certain parties had developed open-source simulation software, which are freely accessible, for the use of studying, reviewing, and conducting modifications on chemical engineering processes. Questions arise whether this free software could produce simulation results as accurate as the commercial software. One such software is DWSIM simulator which is being investigated in this project. In this study, various steady-state process simulations were conducted using DWSIM simulator to assess the viability of this simulator as a potential alternative software to be used in certain chemical engineering subjects by evaluating the accuracy of its simulation results. This was done by simulating several steady-state processes that were commonly found in Chemical Engineering syllabus such as Materials and Energy Balances and the simulation results were then compared to those obtained by Aspen Plus and Aspen HYSYS. It was found that the disparity between the commercial software and DWSIM is great. It is agreed that the accepted percentage error is not more than 5% [1]. This is because the percentage error obtained from this study is inconsistent. It has been proved that, DWSIM simulator can be used to perform a simulation but it requires further improvement to be implemented in the chemical engineering syllabus.

Keywords: Process simulation, DWSIM, Aspen Plus, alternative software

1. BACKGROUND OF STUDY

1.1 Introduction

Process simulation is a model-based interpretation of the chemical, physical, biological and other technical processes and unit operations in a software. The process simulation describes the processes in flow diagrams where unit operations are set up and connected to the product or educt streams. The software works out the mass balance and energy balance to get a stable operating point on the specified parameters. [2]

The objective of a process simulation is to achieve the ideal conditions for a process. This is fundamentally an optimization problem which must be solved in an iterative process. [2] Other than that, process simulation is also able to create a secure, virtual environment in which each of those features can be analyzed and enhanced across a full range of production levels. [3] Process simulation is a potent software tool that permits refinery owners, operators, and engineers to virtually model a process in detail without having to spend the time, manpower, or finance physically examining the model in a real-world environment. [4]

The process simulation software can be separated into two categories, the commercial-source simulation software and open-source simulation software. The commercial-source simulation software is the software that needs to be purchased from the market and these types of simulation software require the users to purchase the legal license as well. The examples of commercial-source simulation software are ASPEN Plus, ASPEN HYSYS, ProSim Plus, and UniSim software. On the other hand, the open-source simulation software is the type of software that can be downloaded directly from the internet and does not require the users to purchase any license. The examples of open-source simulation software are DWSIM, COCO simulator, HYDROFLO and OpenModelica. [1]

This research study is focusing on the open-source simulation software and the simulation software that is chosen is DWSIM simulator. Multiple simulation processes had already been conducted using the DWSIM simulator to achieve the objectives of this research study. The results obtained by the DWSIM simulator are compared with the results obtained by one of the commercial-source simulation software, ASPEN Plus.

1.2 Problem Statement

The need to use an open – source simulator arises when students do not have access to the commercial simulator software at the university campus due to the Corona Virus pandemic. Subjects like Material and Energy Balances (CHE 263) and Introduction to Chemical Engineering Plant Design (CHE 231) need to use that simulator software since it is a part of the syllabus. DWSIM is one of the potential alternatives to the existing commercial simulator like Aspen Plus. In this project, DWSIM as a simulator was evaluated whether it is on par with the existing commercial simulator.

1.3 Objective

First, the objective of this research study is to study the possibility of the open-source chemical process simulator as alternative simulation software for the UiTM. During the Covid-19 pandemic, chemical engineering students face a difficulty to access the commercial simulation software such as Aspen Plus, that usually could be accessed in the university's computer laboratory. The implementation of DWSIM Simulator in chemical engineering subject will help to ease the learning process of each student especially those who are taking Material and Energy Balances (CHE 263) and Introduction to Chemical Engineering Plant Design (CHE 231) subjects. However, the idea to implement this open-source simulator in the chemical engineering subject will be depending on the accomplishment of the simulation.

Other than that, the objective of this research study is also to determine the accuracy of open-source simulators compared to commercial source simulators in chemical engineering studies. Due to making it easier for students to access the simulator software instead of buying the commercial simulator software license, this research study is done to make sure the free simulator software is working and accurate as equivalent to the commercial simulator software. This includes the quality of the simulation, the control of the simulator and the results after running the simulation process. [6] Hence, to evaluate its accuracy, an acceptable percentage error has been standardized.