

CHBE 455: Reactor Design Project

Due: April 01, 2018 9:00 PM

Project Description:

Unlike what you've learned in CHBE 241, real chemical processes do not operate at steady state. External disturbances in various forms will always be present and will drive processes towards transient behaviour.

As a process engineer, your job is to utilize the chemical engineering fundamentals that you've learned in school to develop an in-depth understanding of the process of interest. Strong understanding of the process will help you design robust control systems and operate your units in a safe manner.

For example, while it is easy to say that the concentration of a stream coming out of a reactor will be constant and vary with a certain theoretical model, such situations will only ever occur in certain ideal situations with known assumptions such as computer simulations. In practice, the concentration measurements are often noisy and less predictable.

Summary of Tasks:

This project is designed to have you consider real life conditions of reactor operation and design of control systems. The project will consist of two components:

1. **Developing** a Python simulation of the Belousov-Zhabotinsky (BZ) reaction using known reaction kinetics and theoretical models from literature
2. **Writing** a design proposal for a quality control system to measure analyte concentration during the reaction

Simulation:

[The problem statement of the simulation are in the Jupyter notebook attached.]

Quality Control:

In process engineering sophisticated instrumentation is used to ensure product quality and consistency. Knowledge of methods to measure and determine the composition of chemicals within reactors is critical to running a successful process. There are many sensor types and measurement methods and as part of the design process selecting the right instrumentation can make or break a business. To that end, you are assigned a theoretical budget of 200 Vikram Bucks (exchange rate \$1 CAD = 1\$ VB) to devise a system to measure the concentration of analytes within the Belousov-Zhabotinsky reaction. You must provide an X page written report describing your proposed system and its main operating principles in addition to an item list (using real life items found from any supplier website). References must be provided for all statements made. Emphasis in marking will be put on unique and creative designs and concepts.

Required Elements:

Introduction - ½ page

Simulation - both Jupyter notebooks and its PDF version with all questions answered

Quality Control - 1 page description of design including schematic of instrumentation and process measurement scheme

References -

Submission:

Each report must be submitted electronically. Print the report with a cover page (include your name(s), course number, student ID, word count).

Your submission may look like this:

- Word document with the introduction and the quality control system design
- Jupyter notebook with answered theoretical questions
- A PDF obtained from your Jupyter notebook