%% CHEN 320 - 202 Homework 3

% Problem: 1

% Author: Nathaniel Thomas

% Date: 09/23/2022

% Due: 09/25/2022

% [i] stages take solvent W, which contains X\_in of A, and solvent S, which

% contains Y\_in fraction of A. W and S are immiscible, and A is extraced

% from W.

% Equilibrium is reached in each stage. The equation is as follows;

S = 1000; % Right stream flow rate, kg/hr (Assume constant)

W = 2000; % Left stream flow rate, kg/hr (Assume constant)

X\_in = 0.05; % Left stream composition

Y\_in = 0.00; % Right stream composition

K = 10; % Equilibrium constant

N = 10; % Number of stages.

clc;

% Matrix for storing information on composition of the W and S streams.

% Rows are stages, columns are X values

X = zeros(N, N + 1);

for i = (2:N + 1)

X(i - 1, i - 1) = 1;

X(i - 1, i) = -(1 + K\*S/W);

X(i - 1, i + 1) = (K\*S/W);

end

A = zeros(N, 1);

A(1, 1) = -0.05;

res = X\A;

res;

rec = 100\*(X\_in - res(10))/X\_in;

fprintf("Final percent recovery: %.10f%% \n", rec);

Output:

Final percent recovery: 99.9999508480%

%% CHEN 320 - 202 Homework 3

% Problem: 2

% Author: Nathaniel Thomas

% Date: 09/23/2022

% Due: 09/25/2022

clc

A\_init = 1.0; % Initial concentration of A in the reactor, gmol/litre

% Rate constants for all reactions, forward and backwards, 1/s

K\_ab = 0.1; K\_ba = 0.02; K\_bc = 0.5; K\_cb = 0.1; K\_cd = 0.01; K\_dc = 0.1;

K\_da = 0.05; K\_ad = 0.2; K\_bd = 0.3; K\_db = 0.1;

% Concentration generation of all components [C\_A, C\_B, C\_C, C\_D]

C = [-K\_ab - K\_ad, K\_ba, 0, K\_da;

K\_ab, -K\_ba - K\_bc - K\_bd, K\_cb, K\_db;

0, K\_bc, -K\_cb - K\_cd, K\_dc;

K\_ad, K\_bd, K\_cd, -K\_da - K\_dc - K\_db;

1, 1, 1, 1];

A = [0, 0, 0, 0, 1]';

res = C\A;

fprintf("The concentrations of A, B, C, and D are:\n %.5f, %.5f," + ...

" %.5f, and %.5f gmol/litre.\n", ...

res(1), res(2), res(3), res(4));

Output:

The concentrations of A, B, C, and D are:

0.03856, 0.10870, 0.66487, and 0.18788 gmol/litre.