CHEMOSTAT DYNAMICS-try 2

```
function [ dSdt ] = chemostat_dynamics(t,S,params)
% this function defines the chemostat differential equation
% DO I NEED TO ADD ANOTHER FUNCTION FOR THE SECOND NUTRIENT???
% get the individual parameters from the vector
%
q    = params(1);
u    = params(2);
v    = params(3);
r    = params(4);
K    = params(5);
L    = params(6);
ep   = params(7);
fp   = params(8);
%
% initialize the state's derivative
%
dSdt = zeros(size(S));
%
% put things in terms of individual variables
%
x = S(1); % cells
y = S(2); % glucose
z = S(3); % ammonium
%
% form the differential equation formulae
%
ryz   = r*(y/(K+y))*(z/(L+z));
dxdt  = (ryz)*x - q*x;
dydt  = q*(u - y) - ep*ryz*x;
dzdt  = q*(u - z) - fp*ryz*x;
%
% put things back in terms of state vector variable
%
dSdt(1) = dxdt;
dSdt(2) = dydt;
dSdt(3) = dzdt;
end
```

CHEMOSTAT SCRIPT

```
clear all

t0  = 0;      % initial time
t1  = 100;    % final time
x0  = 10;     % initial cell population
y0  = 25;     % initial glucose concentration
z0  = 46;     % initial ammonium concentration
%
% NOT SURE HOW x0, y0, AND z0 ARE SUPPOSED TO BE FOUND…
%
% initial state for use in DE solver.
%
S0  = [x0;y0;z0];
%
```

```
% rate constants and problem parameters
%
q    = 0.03;
u    = 25;
v    = 46;
r    = 0.1;
K    = 8;
L    = 10;
ep   = 0.95;
fp   = 0.97;
%
% rate constants into parameter vector
%
params(1) = q;
params(2) = u;
params(3) = v;
params(4) = r;
params(5) = K;
params(6) = L;
params(7) = ep;
params(8) = fp;
%
% NOT SURE WHAT r, K, L, ep, AND fp ARE SUPPOSED TO BE…
% define function for fixed parameter values
%
chemostat_dynamics_params = @(t,S)chemostat_dynamics(t,S,params);
%
% call the matlab function to solve the DE for us.
%
[t,St] = ode45(chemostat_dynamics_params,[t0 t1],S0);
%
% I HAVE NO IDEA WHAT THIS MEANS…
% Plot the results.
%
plot(t,St,'LineWidth',3)

legend('cells','glucose','ammonium')
xlabel('time')
ylabel('states')
```