

Chemostat Script 2nutrient Dynamics (script):

```
clear all

t0 = 0; %initial time

t1 = 100; % final time

x0 = 1; % initial cell population

y0 = 2; % initial yeast concentration

z0 = 1.1;

%

% initial state for use in DE solver.

%

S0 = [x0;y0;z0];

%

% rate constants and problem parameters

%

r = 0.46;

K = 0.778;

ep = 14.3;

u = 25;

q = 0.03;

ef = 2.23;

v = 5;

l = 15.91;

%

% rate constants into parameter vector

%

params(1) = r;

params(2) = K;

params(3) = ep;

params(4) = u;
```

```

params(5) = q;
params(6) = ef;
params(7) = v;
params(8) = l;
%
% define function for fixed parameter values
%
chemostat_dynamics_params = @(t,S)chemostat_2nutrient_dynamics(t,S,params);
%
% call the matlab function to solve the DE for us.
%
[t,St] = ode45(chemostat_dynamics_params,[t0 t1],S0);
%
% Plot the results.
%
plot(t,St,'LineWidth',3)

legend('cells','food')
xlabel('time')
ylabel('states')

```

***Chemostat Script 2nutrient Dynamics: ***

```

function [ dSdt ] = chemostat_2nutrient_dynamics(t,S,params)
% this function defines the chemostat differential equation
%
% get the individual parameters from the vector
%
r = params(1);
K = params(2);

```

```

ep = params(3);
u = params(4);
q = params(5);
ef = params(6);
v = params(7);
l = 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); % food
z = S(3);

%
% form the differential equation formulae
%
ryz = r*y/(K+y)*(z/z+l);
dxdt = (ryz)*x - q*x;
dydt = q*(u - y) - ep*ryz*x;
dzdt = q*(v - z) - ef*ryz*x;

%
% put things back in terms of state vector variable
%
dSdt(1) = dxdt;
dSdt(2) = dydt;
dSdt(3) = dzdt;

```

end

