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| %Lecture9 parameter fitting homework.m  global mu\_a mu\_n k\_da k\_dn k\_a k\_n K\_a K\_n Y\_a Y\_n  % this solver uses nh3fcn function file for input  % also see pages 772-776 in Chapra and Canale, 4th ed Numerical methods for  % engineers    % \*\*\* Input Data \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  temp=15; %C  t\_start=0; %d  t\_end=20; %d  % initial conditions (SET THESE TO INITIAL VALUES TO REDUCE ERROR)  % NH3\_int=1.8 % mg/L  % NO2\_int=0.1 % mg/L  % NO3\_int=2.8 % mg/L  AOB\_int=0.3e6; % initial AOB pop cells/L  NOB\_int=0.4e6; % initial NOB pop cells/L  % conversion factors:  % parameter ranges found in Metcalf & Eddy page 705 Table 8-11  % \*\*\*\*\*\* ONLY ADJUST THESE 4 CONSTANTS FOR THE HW PROBLEM \*\*\*\*\*\*  % mu\_a= 0.45; %1/d max AOB growth rate 0.20-0.90  % mu\_n= 1.2; %1/d max NOB growth rate  % k\_da=0.05; %1/d AOB death rate 0.05-0.15  % k\_dn=0.05; %1/d NOB death rate    NH3\_int= 1.82 % mg/L  NO2\_int= 0.085 % mg/L  NO3\_int= 2.85 % mg/L    mu\_a= 0.45 %1/d max AOB growth rate 0.20-0.90  mu\_n= 1.674 %1/d max NOB growth rate  k\_da= 0.053 %1/d AOB death rate 0.05-0.15  k\_dn= 0.118 %1/d NOB death rate    % \*\*\*\*\*\*\*\*\*\* LEAVE THESE VALUES FIXED \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  Y\_a=1; % yield of AOB cell/mg of NH3 0.1-0.15  Y\_n=1; % yield of NOB cell/mg of NO2  K\_a=0.5; % half saturation const mg/L 0.5-1.0  K\_n=0.5; % mg/L  theta\_n=1.07; % 1.06-1.123 these theta values are for temp adjustment  theta\_K=1.053; %1.03-1.123  theta\_d=1.04; %1.03-1.08  cpg\_aob=5e9; % AOB cells per gram (4x10^12 Grant, 1994)  cpg\_nob=5e9; % NOB  % \*\*\* start the computation \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  figure(1)  mu\_a=mu\_a\*theta\_n^(temp-20); %1/d max AOB growth rate 0.20-0.90  mu\_n=mu\_n\*theta\_n^(temp-20); %1/d max NOB growth rate  k\_da=k\_da\*theta\_d^(temp-20); %1/d AOB death rate 0.05-0.15  k\_dn=k\_dn\*theta\_d^(temp-20); %1/d NOB death rate  k\_a=mu\_a/Y\_a; % max NH3 utilization rate  k\_n=mu\_n/Y\_n; % max NO2 utilization rate  K\_a=K\_a\*theta\_K^(temp-20); % half saturation const mg/L 0.5-1.0  K\_n=K\_n\*theta\_K^(temp-20);  AOB\_int=AOB\_int\*1000/cpg\_aob; % initial AOB VSS g/m^3: mg/L  NOB\_int=NOB\_int\*1000/cpg\_nob; % initial NOB VSS g/m^3: mg/L    [t,y]=ode45(@nh3fcn,[t\_start t\_end],[AOB\_int NOB\_int NH3\_int NO2\_int NO3\_int]);      figure(1)  plot(t,y(:,3),t,y(:,4),t,y(:,5));  title('NH3,NO2,NO3 concentrations OF (3-10-2004)');    ylabel('Nitrogen Concentration as N (mg/L)')  xlabel('Time (d)')  grid  figure(1)    %d nh3 no2 no3  data=[  0 1.82 0.085 2.85  3.00 1.65 0.08 3.00  7.00 1.56 0.16 2.99  11.00 1.37 0.11 3.48  18.00 0.034 0.02 4.54];    hold on  plot(data(:,1),data(:,2),'\*',data(:,1),data(:,3),'x',data(:,1),data(:,4),'o')  legend('NH\_3','NO\_2','NO\_3','location','best')    label0=sprintf('AOB = %g cells/L, NOB = %g cells/L', AOB\_int\*cpg\_aob/1000,NOB\_int\*cpg\_nob/1000)  text(0.5,4.2,label0)    hold off    figure(2)  %calculate relative error between the two data sets  days = [0,3,7,11,18];  y\_interpolated = interp1(t,y,days);  err\_ammonia = [];  err\_nitrite = [];  err\_nitrate = [];  %NH3 is ammonia  %NO2 is nitrite  %NO3 is nitrate  for i=1:length(days)  err\_ammonia(i) = 100\*(abs(data(i,2)-y\_interpolated(i,3))/data(i,2));  err\_nitrite(i) = 100\*(abs(data(i,3)-y\_interpolated(i,4))/data(i,3));  err\_nitrate(i) = 100\*(abs(data(i,4)-y\_interpolated(i,5))/data(i,4));  end    plot(days, err\_ammonia, days, err\_nitrite, days, err\_nitrate);  title('Relative Error of calculated NH3, NO2, and NO3');  legend('Ammonia (NH3)', 'Nitrite (NO2)', 'Nitrate (NO3)');  xlabel('Day');  ylabel('Percentage Error (%)');    **Function File---------------------------------------------------------------**  function [ vector ] = nh3fcn( t,y )  global mu\_a mu\_n k\_da k\_dn K\_a K\_n Y\_a Y\_n    x\_aob = y(1);  x\_nob = y(2);  c\_nh3 = y(3);  c\_no2 = y(4);  c\_no3 = y(5);    dx\_aob = (mu\_a\*c\_nh3\*x\_aob)/(K\_a+c\_nh3)-k\_da\*x\_aob;  dx\_nob = (mu\_n\*c\_no2\*x\_nob)/(K\_n+c\_no2)-k\_dn\*x\_nob;  dc\_nh3 = (-(mu\_a\*c\_nh3\*x\_aob)/(Y\_a\*(K\_a+c\_nh3)));  dc\_no2 = (mu\_a\*c\_nh3\*x\_aob)/(Y\_a\*(K\_a+c\_nh3))-(mu\_n\*c\_no2\*x\_nob)/(Y\_n\*(K\_n+c\_no2));  dc\_no3 = (mu\_n\*c\_no2\*x\_nob)/(Y\_n\*(K\_n+c\_no2));    vector = [dx\_aob; dx\_nob; dc\_nh3; dc\_no2; dc\_no3];    end |





Coefficients

NH3\_int =

1.8200

NO2\_int =

0.0850

NO3\_int =

2.8500

mu\_a =

0.4500

mu\_n =

1.6740

k\_da =

0.0530

k\_dn =

0.1180