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% simple_driver_extended
% Grayson Gerlich 1/15/2022

% I definitely could have automated plotting everything three times, but
% for only 3 repetitions I can copy-paste almost as fast as I can code
% a for loop...

% clear all variable
clear all

% close all figures
close all

% set up the time span over which to simulate
tspan = linspace(0,100,300);

% set up the initial conditions for all the species
% y0 = (X,Y,Z,TF,G,E)
% since it has 6 species, it is a 1 by 6 vector
% set all six initial conditions to 1
y0=ones(1,6);

% set up all parameters to send to the ODE integrator
% p=(a,b,c,d),
p1=[1,1,1,0.05];
p2=[1,1,1,.3];
p3=[1,1,1,.51];

% call the ODE solver ode15s instead of ode45
% to send parameters to the ode solver, use the following command:
[tSol1,ySol1] = ode15s(@(tSol1,ySol1)simple_extended(tSol1,ySol1,p1),tspan,y0);
[tSol2,ySol2] = ode15s(@(tSol2,ySol2)simple_extended(tSol2,ySol2,p2),tspan,y0);
[tSol3,ySol3] = ode15s(@(tSol3,ySol3)simple_extended(tSol3,ySol3,p3),tspan,y0);

% plot the solutions
t = tiledlayout(1,3);

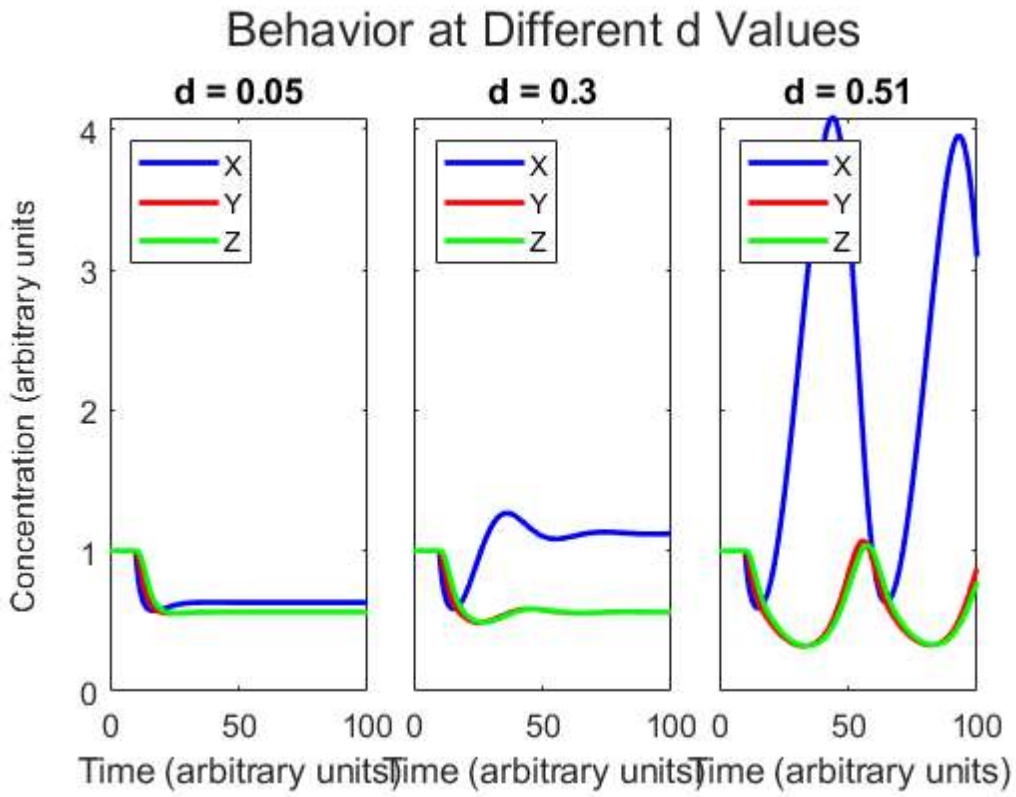
% essentially unchanged plots
t1 = nexttile;
plot(tSol1,ySol1(:,1),'b','LineWidth',2)
hold on
plot(tSol1,ySol1(:,2),'r','LineWidth',2)
plot(tSol1,ySol1(:,3),'g','LineWidth',2)
xlabel('Time (arbitrary units)')
title('d = 0.05')
legend('X','Y','Z','Location','northwest')
set(gca,'FontSize',12)
hold off

% damped oscillations
t2 = nexttile;
plot(tSol2,ySol2(:,1),'b','LineWidth',2)
hold on
plot(tSol2,ySol2(:,2),'r','LineWidth',2)
plot(tSol2,ySol2(:,3),'g','LineWidth',2)
xlabel('Time (arbitrary units)')
title('d = 0.3')
legend('X','Y','Z','Location','northwest')
set(gca,'FontSize',12)
```

```
hold off

% stable oscillations
t3 = nexttile;
plot(tSol3,ySol3(:,1),'b','LineWidth',2)
hold on
plot(tSol3,ySol3(:,2),'r','LineWidth',2)
plot(tSol3,ySol3(:,3),'g','LineWidth',2)
xlabel('Time (arbitrary units)')
title('d = 0.51')
legend('X','Y','Z','Location','northwest')
set(gca,'FontSize',12)
hold off

% clean everything up a bit
linkaxes([t1,t2,t3],'y');
title(t, 'Behavior at Different d Values','FontSize',18);
ylabel(t,'Concentration (arbitrary units', 'FontSize',12);
t.TileSpacing = 'compact';
yticklabels([t2, t3],{});
axis([0 tspan(end) 0 max(ySol3(:,1))])
```



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