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clear all
close all
format long
warning off all

%Purpose: The purpose of this experiment was to take two systems (system 3
%and system 21 in chapter 9.4) and observe the transition between the two.
%Essentially, (1-alpha)*system3+alpha*system21 (alpha = 0:0.1:1)

sys3 = @(t, x) [x(1)*(1-x(1)-x(2)); x(2)*(0.75-x(2)-0.5*x(1))];
sys21 = @(t, x) [x(1)*(1-x(1)-x(2)); x(2)*(0.5-0.25*x(2)-0.75*x(1))];

xa1 = ones(40, 2);
xa2 = ones(40, 2);

for alpha = 0:0.1:1
    figure; hold on
    for a = 0:0.3:1.5
        for b = 0:0.1:1

            [t1, xasys3] = ode45(sys3, [0 20], [a*b a*2.5*(1-b)]);
            for j = 1:2
                for i=1:40
                    xa1(i, j) = 0.0;
                    xa1(i, j) = xasys3(i, j);
                end
            end

            [t2, xasys21] = ode45(sys21, [0 20], [a*b a*2.5*(1-b)]);
            for j = 1:2
                for i=1:40
                    xa2(i, j) = 0.0;
                    xa2(i, j) = xasys21(i, j);
                end
            end

            xa3 = (1-alpha).*xa1 + alpha.*xa2;
            plot(xa3(:,1), xa3(:,2))

            [t1, xasys3] = ode45(sys3, [0 -5], [a*b a*2.5*(1-b)]);
            for j = 1:2
                for i=1:40
                    xa1(i, j) = 0.0;
                    xa1(i, j) = xasys3(i, j);
                end
            end

            [t2, xasys21] = ode45(sys21, [0 -5], [a*b a*2.5*(1-b)]);
            for j = 1:2
                for i=1:40
                    xa2(i, j) = 0.0;
                    xa2(i, j) = xasys21(i, j);
                end
            end

            xa3 = (1-alpha).*xa1 + alpha.*xa2;
            plot(xa3(:,1), xa3(:,2))
        end
    end
end

[X, Y] = meshgrid(0:0.1:1.6, 0:0.1:2.2);
U1 = X.*(1 - X - Y);
V1 = Y.*(0.75 - Y - 0.5.*X);
U2 = X.*(1 - X - Y);
V2 = Y.*(0.5 - 0.25.*Y - 0.75.*X);
L1 = sqrt((U1/1.6).^2 + (V1/2.2).^2);
L2 = sqrt((U2/1.6).^2 + (V2/2.2).^2);
quiver(X, Y, (1-alpha).*U1./L1 + alpha.*U2./L2, ...
        (1-alpha).*V1./L1 + alpha.*V2./L2, 0.4)

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axis([0 1.6 0 2.2])
xlabel 'x'
ylabel 'y'
title([num2str(1-alpha), ' * system3 and ', num2str(alpha), ' * system21'])
end

disp('See Comments')

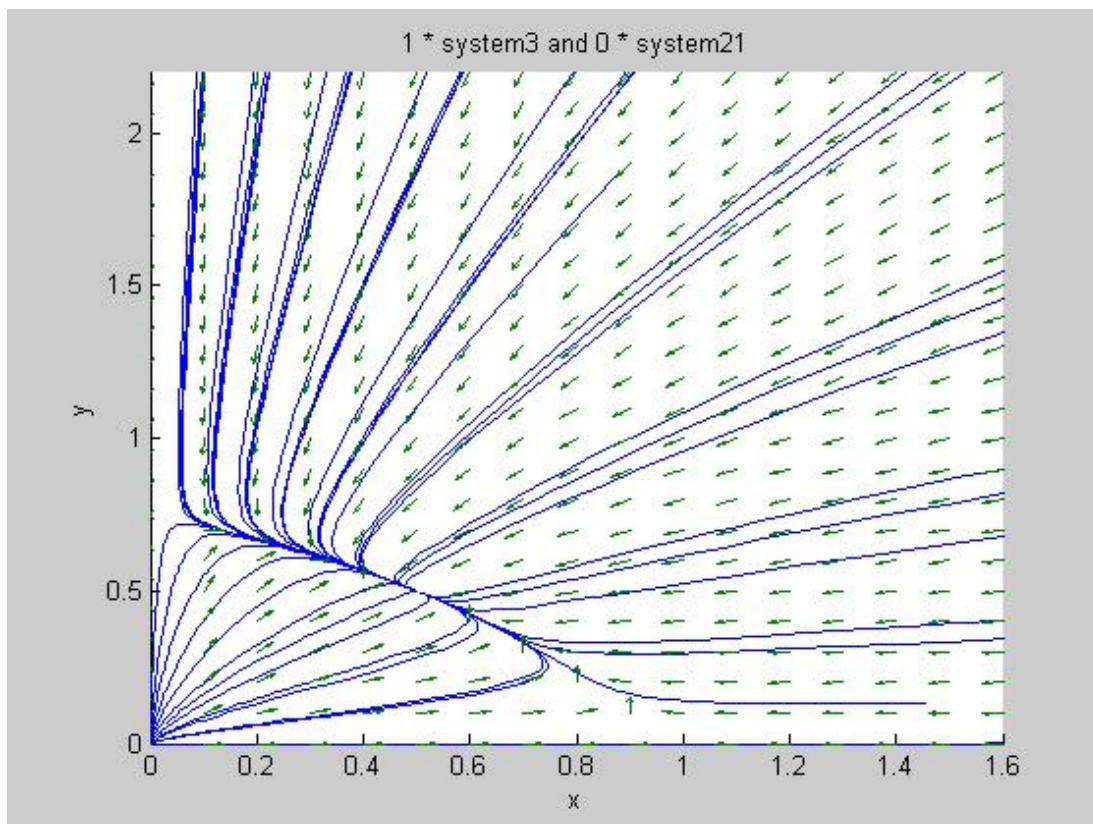
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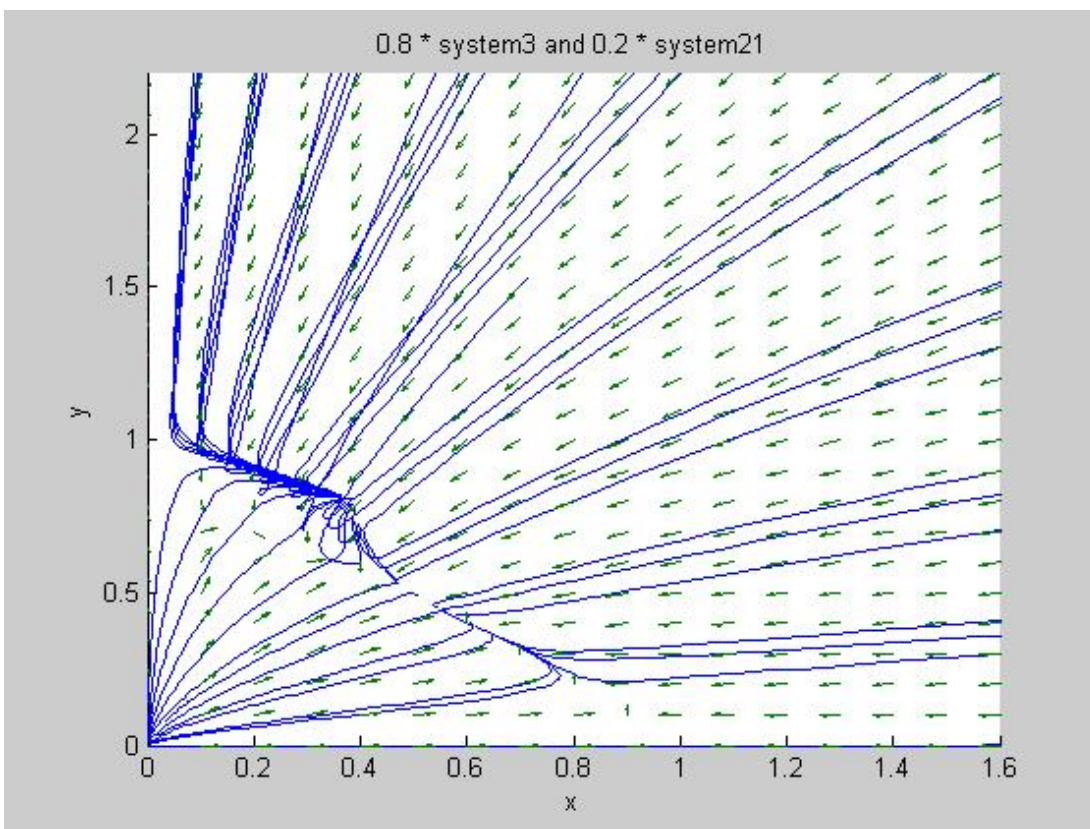
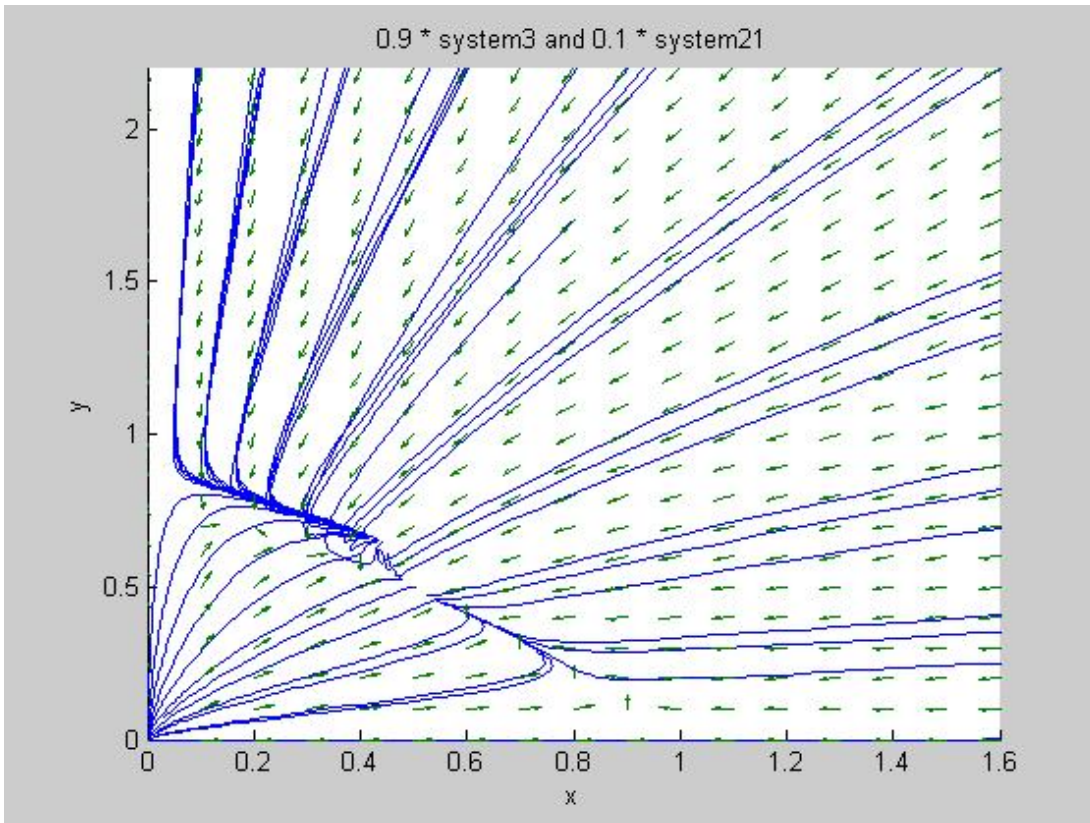
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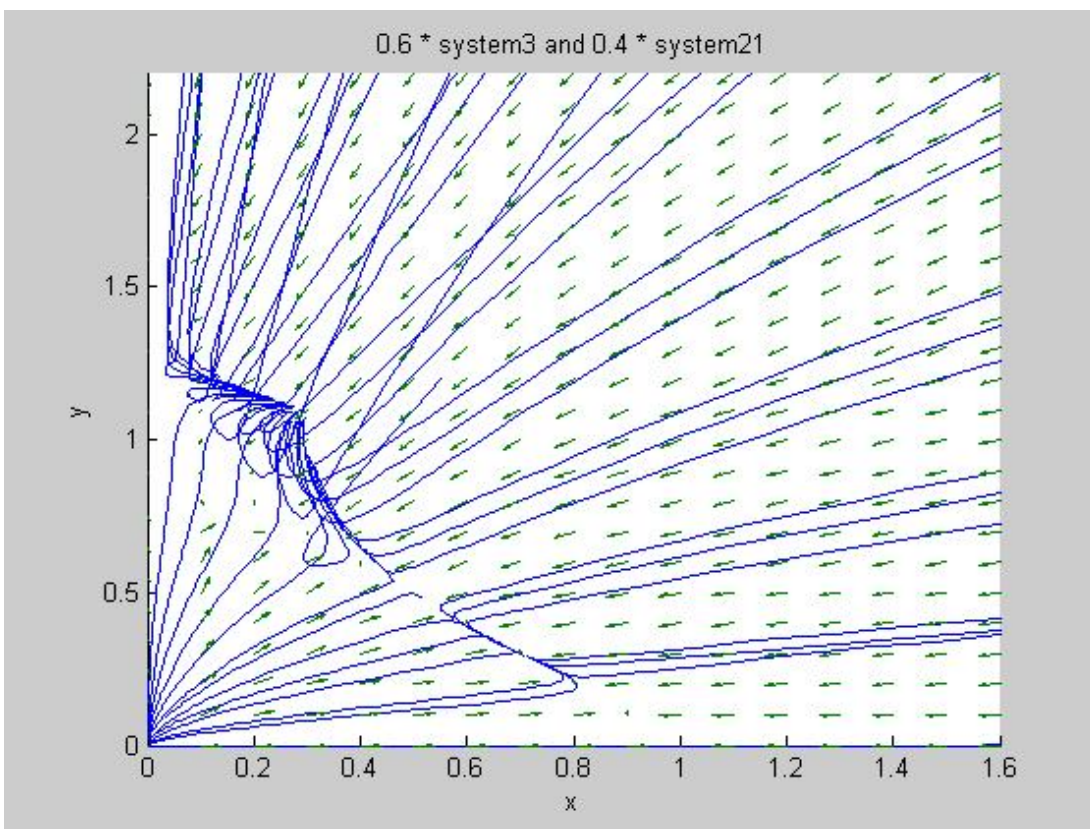
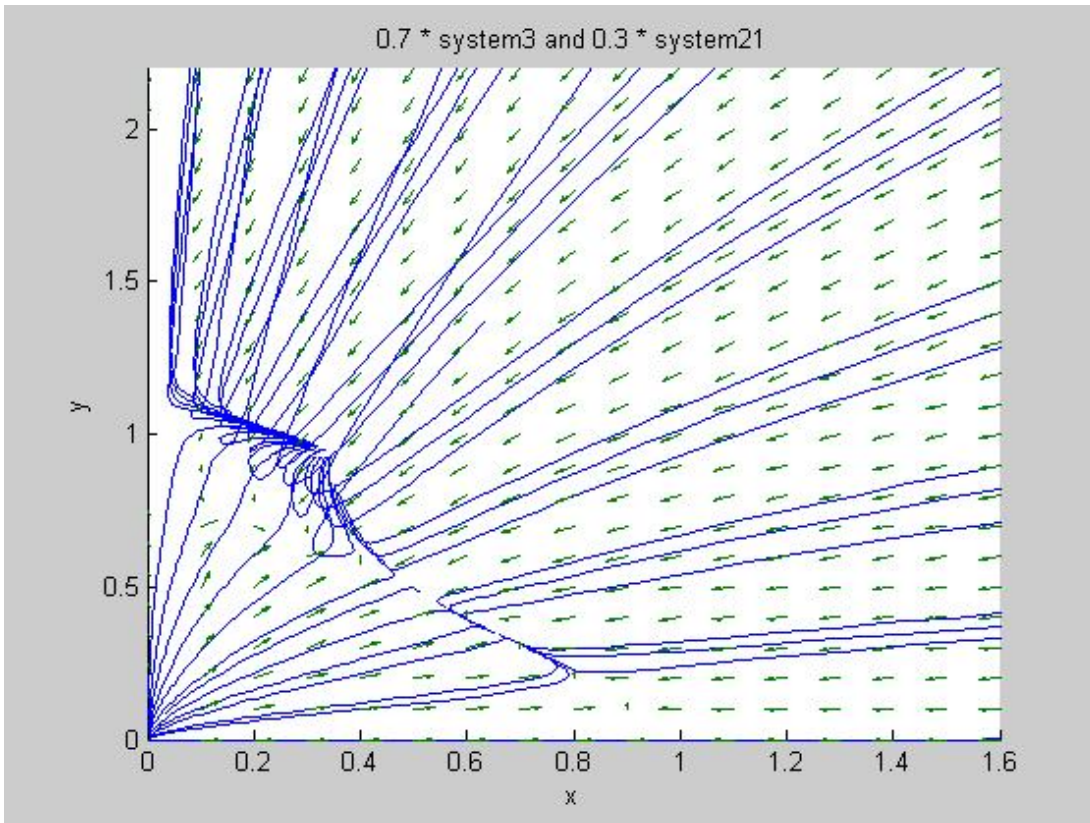
%Even from the beginning, we can see that any influence from system21
%changes the critical points. The significant critical point (i.e.
%the critical point not on the axes) becomes three different critical
%points. One point moves towards (0,2), the other moves towards (1,0), and
%the last stays relatively around (0.5,0.5). The first and second points
%are attracting sinks, while the last point (0.5,0.5) becomes an unstable;
%the last point isn't repelling nor a source as there are two orbits
%heading towards it.
%
%Additionally, the critical point at (1,0) stays where it is throughout the
%changes, while the critical point at (0,0.75) immediately moves towards
%(0,2).
%
%Regarding shape of the line on which the critical point lie, it changes
%from being concave (similar to system3) in Fig. 2 (alpha = 0.1) to being
%convex (similar to system21) in Fig.3 (alpha = 0.2).
%However, by Fig. 5 and 6 (alpha = 0.4 and 0.5 respectively), the graph
%clearly begins to take the shape of system21, the critical points tending
%towards the system21 line rather than the system3 line.
%
%Admittedly, it is only after the entire model represents system21 that one
%of the competing species will die out completely (if not along the
%separatrix that leads to equilibrium)

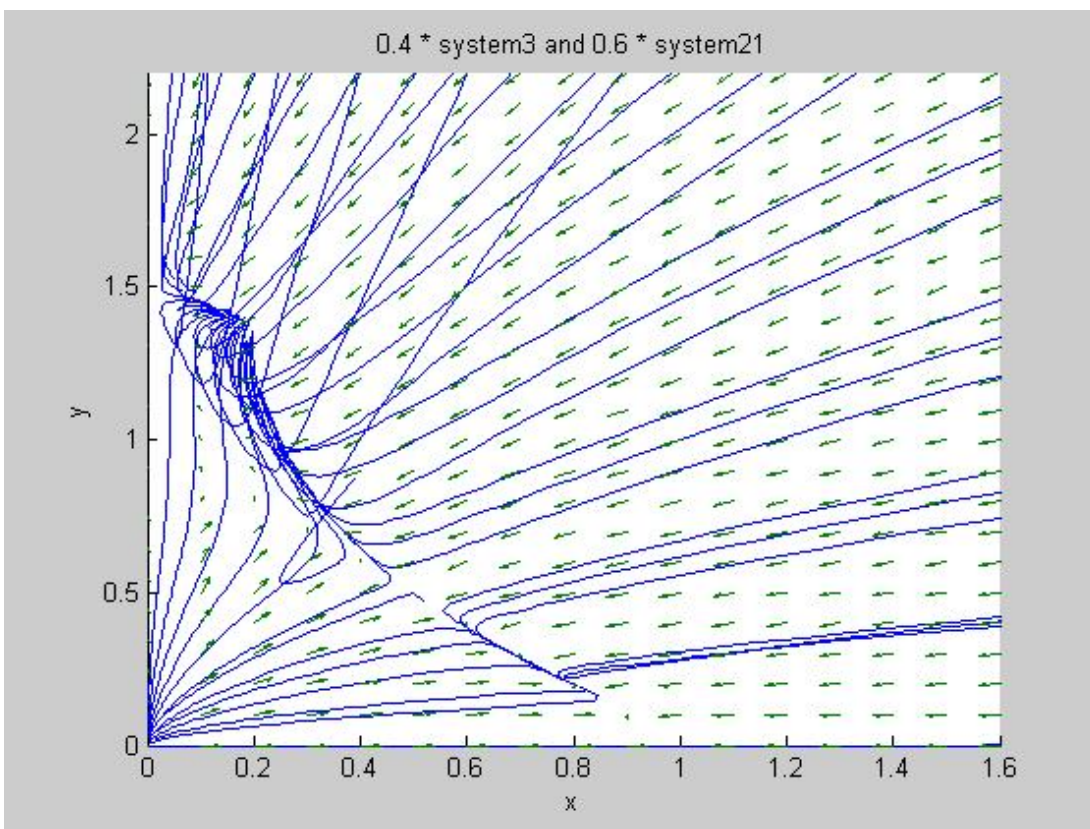
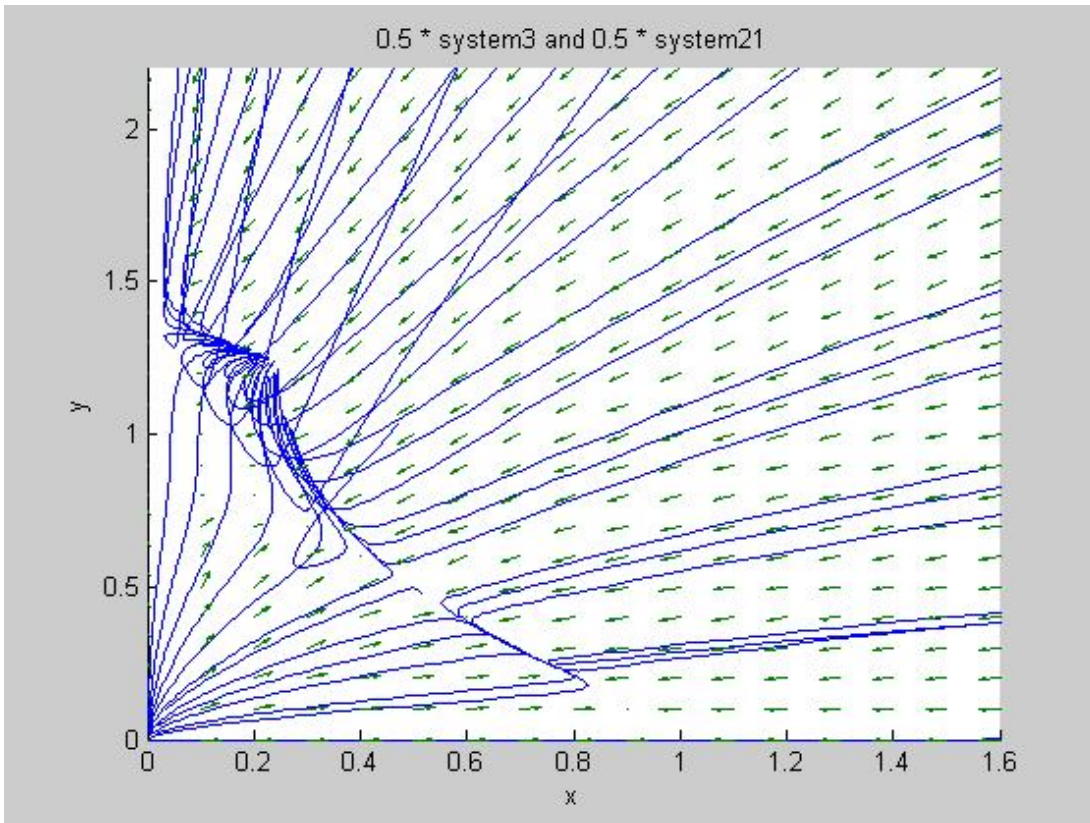
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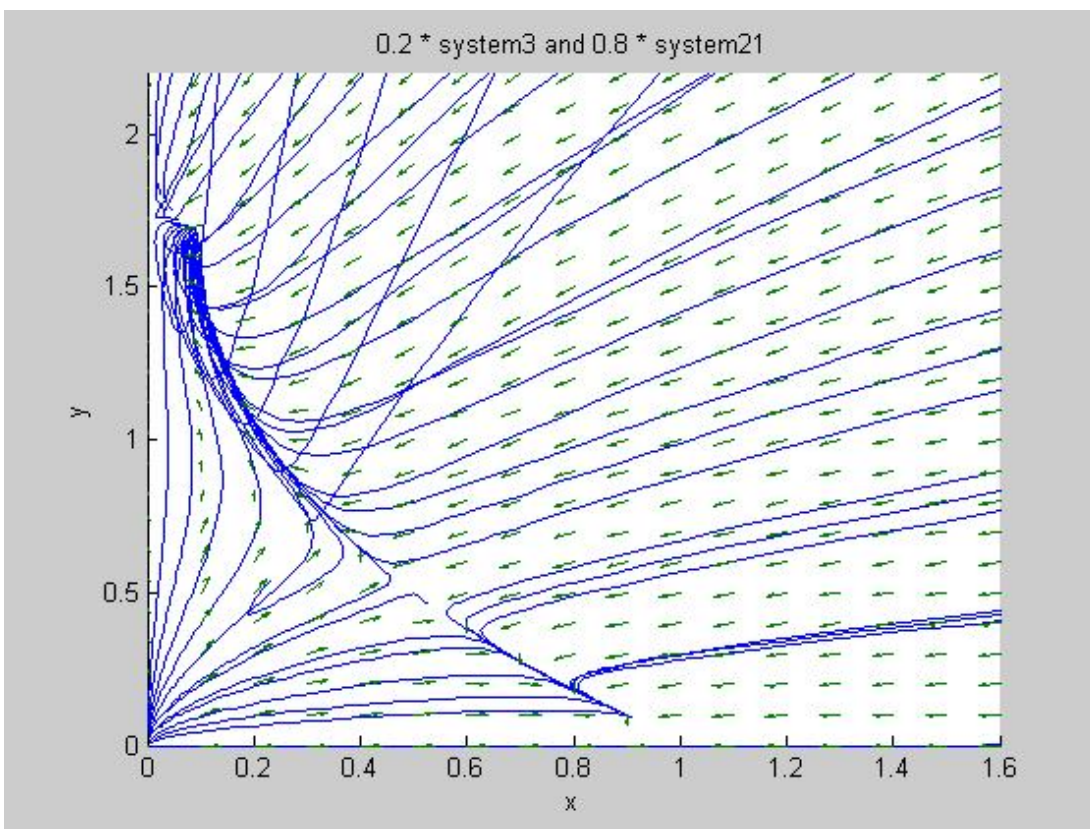
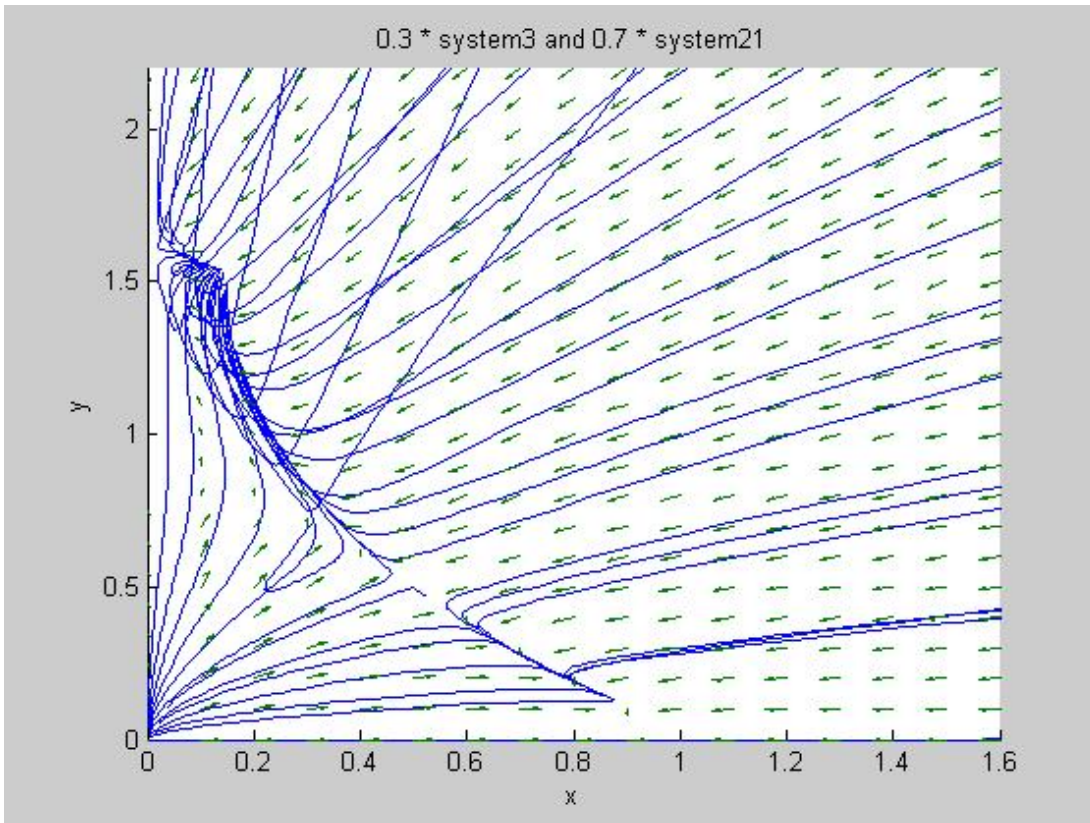
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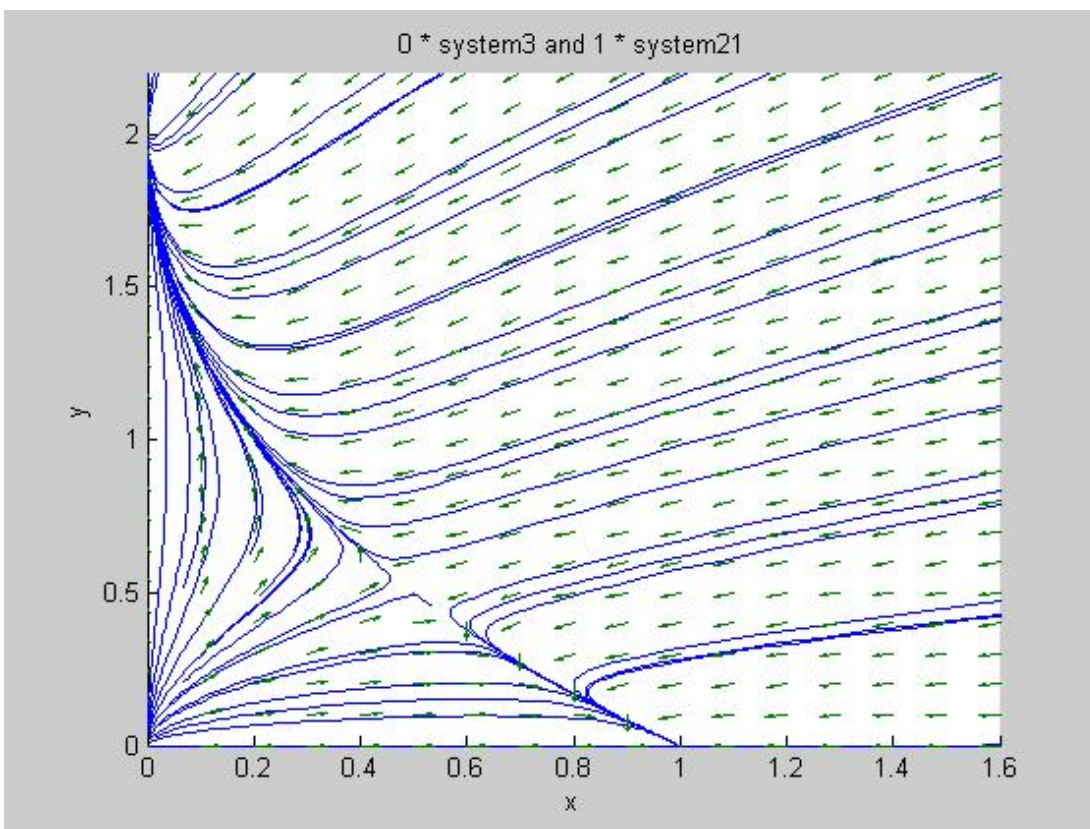
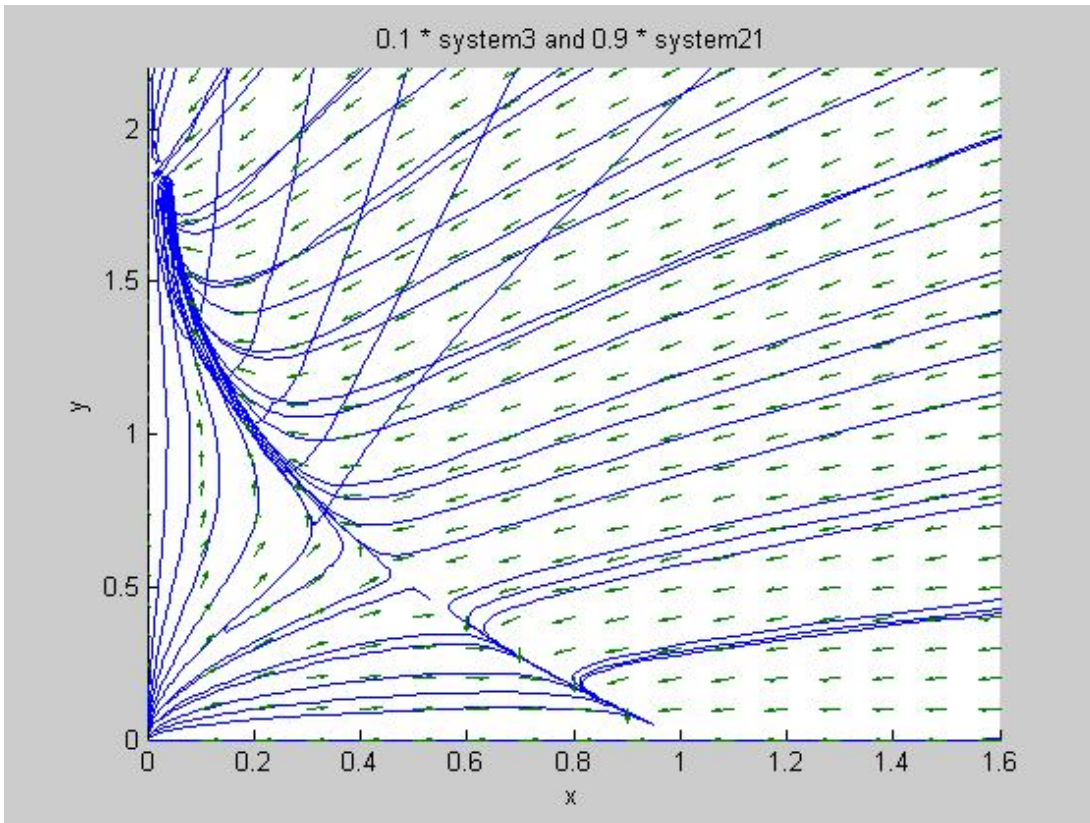












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