%%样本文件

function dydt=yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3)

dydt=zeros(3,1);

dydt(1)=y(1)\*(1-y(1))\*((1-a)\*(L+P)\*y(3)+(1-b)\*(R2-C1)\*y(2)+b\*(R2-C1)+a\*(L+P));

dydt(2)=y(2)\*(1-y(2))\*((1-a)\*D\*y(3)\*y(1)+(a-1)\*(C2+D)\*y(3)+a\*D\*y(1)+I-a\*(C2+D)-R3);

dydt(3)=y(3)\*(1-y(3))\*((a-1)\*D\*y(1)\*y(2)+(1-a)\*D\*y(2)+(a-1)\*(L+P)\*y(1)+(1-a)\*P+(a-1)\*C3);

end

**%%图 ４ 养殖场行为策略概率变化的演化轨迹**

clc,clear;

figure(5);

%P=1

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.3 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on ;

%P=2.5

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on ;

%P=4

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.7 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on ;

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

xlabel('$x$','interpreter','latex');ylabel('$y$','interpreter','latex');zlabel('$z$','interpreter','latex','Rotation',360,'position',[-0.1 1 1.1]);

grid on

hold on

set(0,'defaultfigurecolor','w')

legend({'{\it\fontname{Bodoni MT}x}=0.3','{\it\fontname{Bodoni MT}x}=0.5','{\it\fontname{Bodoni MT}x}=0.7'},'location','northeast');

title('图 ４ 养殖场行为策略概率变化的演化轨迹','FontWeight','bold','position',[0 0 -0.2]);

text(0.4 ,0.2 ,0.3,'$ESS$','interpreter','latex');

annotation('arrow',[0.55 0.35],[0.35 0.32]);

annotation('arrow',[0.58 0.58],[0.38 0.45]);

% the small figure

axes('position',[0.13 0.32 0.2 0.2]);

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.3 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.7 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

set(gca,'XTickLabel','','YTickLabel','','ZTickLabel','')

grid on

hold on

set(0,'defaultfigurecolor','w')

view([0 0]);

xlabel('x','position',[0.8 1 0.3])

zlabel('z','position',[0.1 1 0.8],'Rotation',360)

**%%图 ５ 金融机构行为策略概率变化的演化轨迹**

clc,clear;

figure(5);

%P=1

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.3 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on ;

%P=2.5

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on ;

%P=4

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.7 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on ;

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

xlabel('$x$','interpreter','latex');ylabel('$y$','interpreter','latex');zlabel('$z$','interpreter','latex','Rotation',360,'position',[-0.1 1 1.1]);

grid on

hold on

set(0,'defaultfigurecolor','w')

legend({'{\it\fontname{Bodoni MT}y}=0.3','{\it\fontname{Bodoni MT}y}=0.5','{\it\fontname{Bodoni MT}y}=0.7'},'location','northeast');

title('图 ５ 金融机构行为策略概率变化的演化轨迹','FontWeight','bold','position',[0 0 -0.2]);

text(0.4 ,0.2 ,0.3,'$ESS$','interpreter','latex');

annotation('arrow',[0.55 0.35],[0.35 0.32]);

annotation('arrow',[0.58 0.58],[0.38 0.45]);

% the small figure

axes('position',[0.13 0.32 0.2 0.2]);

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.3 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.7 0.5]);

%plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

stem3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

set(gca,'XTickLabel','','YTickLabel','','ZTickLabel','')

grid on

hold on

set(0,'defaultfigurecolor','w')

view([0 0]);

xlabel('x','position',[0.8 1 0.3])

zlabel('z','position',[0.1 1 0.8],'Rotation',360)

**%% 图 6 约束型环境规制的影响**

clc,clear;

figure(6);

a=0.5,L=3,P=2,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on ;

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on ;

a=0.5,L=3,P=6,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on ;

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

xlabel('$x$','interpreter','latex');ylabel('$y$','interpreter','latex');zlabel('$z$','interpreter','latex','Rotation',360,'position',[-0.1 1 1.1]);

grid on

hold on

set(0,'defaultfigurecolor','w')

legend({'{\it\fontname{Bodoni MT}P}=2','{\it\fontname{Bodoni MT}P}=4','{\it\fontname{Bodoni MT}P}=6'},'location','northeast');

title('图 6 约束型环境规制的影响','FontWeight','bold','position',[0 0 -0.2]);

% the small figure

axes('position',[0.13 0.32 0.2 0.2]);

text(0.5 ,0.5 ,0.5,'$ESS$','interpreter','latex');

text(0.56 ,0.29 ,0.3,'ESS');

annotation('arrow',[0.55 0.35],[0.35 0.32]);

annotation('arrow',[0.58 0.58],[0.38 0.45]);

a=0.5,L=3,P=2,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on

a=0.5,L=3,P=6,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

set(gca,'XTickLabel','','YTickLabel','','ZTickLabel','')

grid on

hold on

set(0,'defaultfigurecolor','w')

view([0 90]); %y-x小图

xlabel('x','position',[0.8 1 0.3])

ylabel('y','position',[0.1 1 0.8],'Rotation',360)

**%% 图 ７ 激励型环境规制的影响**

clc,clear;

figure(6);

a=0.5,L=1,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on ;

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on ;

a=0.5,L=5,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on ;

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

xlabel('$x$','interpreter','latex');ylabel('$y$','interpreter','latex');zlabel('$z$','interpreter','latex','Rotation',360,'position',[-0.1 1 1.1]);

grid on

hold on

set(0,'defaultfigurecolor','w')

legend({'{\it\fontname{Bodoni MT}L}=1','{\it\fontname{Bodoni MT}L}=3','{\it\fontname{Bodoni MT}L}=5'},'location','northeast');

title('图 ７ 激励型环境规制的影响','FontWeight','bold','position',[0 0 -0.2]);

% the small figure

axes('position',[0.13 0.32 0.2 0.2]);

text(0.5 ,0.5 ,0.5,'$ESS$','interpreter','latex');

text(0.56 ,0.29 ,0.3,'ESS');

annotation('arrow',[0.55 0.35],[0.35 0.32]);

annotation('arrow',[0.58 0.58],[0.38 0.45]);

a=0.5,L=1,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on

a=0.5,L=5,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

set(gca,'XTickLabel','','YTickLabel','','ZTickLabel','')

grid on

hold on

set(0,'defaultfigurecolor','w')

view([0 90]); %y-x小图

xlabel('x','position',[0.8 1 0.3])

ylabel('y','position',[0.1 1 0.8],'Rotation',360)

**%%图 ８ 规模化与非规模化养殖场的效应分化**

clc,clear;

figure(6);

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.15,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on ;

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on ;

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.35,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on ;

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

xlabel('$x$','interpreter','latex');ylabel('$y$','interpreter','latex');zlabel('$z$','interpreter','latex','Rotation',360,'position',[-0.1 1 1.1]);

grid on

hold on

set(0,'defaultfigurecolor','w')

legend({'{\it\fontname{Bodoni MT}R\_{3}}=0.15','{\it\fontname{Bodoni MT}R\_{3}}=0.25','{\it\fontname{Bodoni MT}R\_{3}}=0.35'},'location','northeast');

title('图 ８ 规模化与非规模化养殖场的效应分化','FontWeight','bold','position',[0 0 -0.2]);

% the small figure

axes('position',[0.13 0.32 0.2 0.2]);

text(0.5 ,0.5 ,0.5,'$ESS$','interpreter','latex');

text(0.56 ,0.29 ,0.3,'ESS');

annotation('arrow',[0.55 0.35],[0.35 0.32]);

annotation('arrow',[0.58 0.58],[0.38 0.45]);

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.15,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'r+','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.25,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'b-','linewidth',1);

hold on

a=0.5,L=3,P=4,b=0.5,R2=0.1,C1=5,D=0.5,I=0.2,C2=0.05,R3=0.35,C3=0.05;

[t,y]=ode45(@(t,y) yanhuaboyi(t,y,a,L,P,b,R2,C1,D,I,C2,R3,C3),[0 50],[0.5 0.5 0.5]);

plot3(y(:,1),y(:,2),y(:,3),'g--','linewidth',1);

hold on

set(gca,'XTick',[0:0.2:1],'YTick',[0:0.2:1],'ZTick',[0:0.2:1])

axis([0 1 0 1 0 1])

set(gca,'XTickLabel','','YTickLabel','','ZTickLabel','')

grid on

hold on

set(0,'defaultfigurecolor','w')

view([0 90]); %y-x小图

xlabel('x','position',[0.8 1 0.3])

ylabel('y','position',[0.1 1 0.8],'Rotation',360)