

Program S1: Software Source for Figures 1–4

Figure 1:

```
function dy=eq41(t,y,canshu)
dy=zeros(4,1);
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10)
dy(1,1)=a*y(1)-b*y(1)*y(3)+c*y(2)+d*y(3)+e*y(4);
dy(2,1)=-f*y(2)+b*y(1)*y(3);
dy(3,1)=-g*y(3)+i*y(2);
dy(4,1)=-h*y(4)+j*y(3)
%y(1) denotes Ns; y(2) denotes Ne; y(3) denotes Ni; y(4) denotes Nr.
end
clear
clc
canshu=[-0.02,0.00023,0.045,0.0425,0.08,0.275,0.2225,0.15,0.15,0.1];
[t,y]=ode23(@(t,y) eq41(t,y,canshu),[0,1000],[1500,1000,500,0]);
plot(t,y(:,1));
hold on
plot(t,y(:,2));
hold on
plot(t,y(:,3));
hold on
plot(t,y(:,4));
legend('N_s','N_e','N_i','N_r');
```

Figure 2:

```
function dy=eq41(t,y,canshu)
dy=zeros(4,1);
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10)
dy(1,1)=a*y(1)-b*y(1)*y(3)+c*y(2)+d*y(3)+e*y(4);
dy(2,1)=-f*y(2)+b*y(1)*y(3);
dy(3,1)=-g*y(3)+i*y(2);
dy(4,1)=-h*y(4)+j*y(3)
clear
clc
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.275,0.2225,0.15,0.15,0.1];
[t,y]=ode23(@(t,y) eq41(t,y,canshu),[0,1000],[1500,1000,500,0]);
plot(t,y(:,1));
hold on
plot(t,y(:,2));
hold on
plot(t,y(:,3));
hold on
```

```
plot(t,y(:,4));
legend('N_s','N_e','N_i','N_r');
```

Figure 3 (a):

```
function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
End
clear
clc
lags=4.3526
history=[1500,1000,500,0];
tspan=[0,26000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:4529;
plot(t,sol.y(1,:));
hold on
plot(t,sol.y(2,:));
hold on
plot(t,sol.y(3,:));
hold on
plot(t,sol.y(4,:));
legend('N_s','N_e','N_i','N_r');
```

Figure 3 (b):

```
function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
End
clear
clc
lags=4.3526
```

```

history=[1500,1000,500,0];
tspan=[0,8600];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:9171;
plot3(sol.y(1,:),sol.y(2,:),sol.y(3,:))
xlabel('N_s');
ylabel('N_e');
zlabel('N_i');

```

Figure 4 (a):

```

function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
end
clear
clc
lags=6.3526
history=[1500,1000,500,0];
tspan=[0,26000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:7632;
plot(t,sol.y(1,:));

```

Figure 4 (b):

```

function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
end
clear
clc
lags=6.3526

```

```

history=[1500,1000,500,0];
tspan=[0,26000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:7632;
plot(t,sol.y(2,:));

```

Figure 4 (c):

```

function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
end
clear
clc
lags=6.3526
history=[1500,1000,500,0];
tspan=[0,26000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:7632;
plot(t,sol.y(3,:));

```

Figure 4 (d):

```

function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
end
clear
clc
lags=6.3526
history=[1500,1000,500,0];
tspan=[0,26000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);

```

```
t=0:7632;
plot(t,sol.y(4,:));
```

Figure 4 (e):

```
function dy= myddefun(t,y,Z,canshu)
a=canshu(1);b=canshu(2);c=canshu(3);d=canshu(4);e=canshu(5);f=canshu(6);g=canshu(7);h=canshu(8);i=canshu(9);j=canshu(10);
dy=[a*y(1)-b*y(1)*Z(3,1)+c*y(2)+d*y(3)+e*y(4)
-f*y(2)+b*y(1)*Z(3,1)
-g*y(3)+i*y(2)
-h*y(4)+j*y(3)];
% Z is the part of time delay, that is, y(3)(t-T), where T is the time delay; Z (i, j) means y (i) (t-T), which is the time-delay form of y (i); j means T select j-th value of time delay selected by T.
end
clear
clc
lags=6.3526
history=[1500,1000,500,0];
tspan=[0,1000];
canshu=[0.11,0.00023,0.045,0.0425,0.08,0.285,0.2225,0.15,0.16,0.1];
sol= dde23(@(t,y,Z) myddefun(t,y,Z,canshu),lags,history,tspan);
t=0:9171;
plot3(sol.y(1,:),sol.y(2,:),sol.y(3,:))
xlabel('N_s');
ylabel('N_e');
zlabel('N_i');
```