```
classdef PassiveLocation < matlab.apps.AppBase
%
    % Properties that correspond to app components
    properties (Access = public)
        UIFigure          matlab.ui.Figure
        chanButton        matlab.ui.control.Button
        TabGroup2         matlab.ui.container.TabGroup
        Tab_2             matlab.ui.container.Tab
        Panel_2           matlab.ui.container.Panel
        Panel_6           matlab.ui.container.Panel
        Button_5          matlab.ui.control.Button
        Button_4          matlab.ui.control.Button
        Button_3          matlab.ui.control.Button
        Button            matlab.ui.control.Button
        Label_27          matlab.ui.control.Label
        Label_26          matlab.ui.control.Label
        Label_25          matlab.ui.control.Label
        Label_24          matlab.ui.control.Label
        Label_23          matlab.ui.control.Label
        Label_22          matlab.ui.control.Label
        Label_21          matlab.ui.control.Label
        Label_20          matlab.ui.control.Label
        Label_19          matlab.ui.control.Label
        Label_18          matlab.ui.control.Label
        Label_17          matlab.ui.control.Label
        Label_16          matlab.ui.control.Label
        Knob_2            matlab.ui.control.DiscreteKnob
        Knob              matlab.ui.control.Knob
        Label_29          matlab.ui.control.Label
        T                 matlab.ui.control.NumericEditField
        TsLabel           matlab.ui.control.Label
        dt                matlab.ui.control.NumericEditField
        dtsLabel          matlab.ui.control.Label
        VmsLabel          matlab.ui.control.Label
        v                 matlab.ui.control.NumericEditField
        MSmLabel          matlab.ui.control.Label
        BS2mLabel         matlab.ui.control.Label
        BS1mLabel         matlab.ui.control.Label
        MS_z              matlab.ui.control.NumericEditField
        MS_y              matlab.ui.control.NumericEditField
        MS_x              matlab.ui.control.NumericEditField
        BS2_z             matlab.ui.control.NumericEditField
        BS2_y             matlab.ui.control.NumericEditField
        BS2_x             matlab.ui.control.NumericEditField
        BS1_z             matlab.ui.control.NumericEditField
        BS1_y             matlab.ui.control.NumericEditField
        BS1_x             matlab.ui.control.NumericEditField
        moni_zhuangtai    matlab.ui.control.TextArea
        Label_15          matlab.ui.control.Label
        Lamp              matlab.ui.control.Lamp
        Label_14          matlab.ui.control.Label
```

```
Panel             matlab.ui.container.Panel
result_moni       matlab.ui.control.EditField
Label_3           matlab.ui.control.Label
mLabel_3          matlab.ui.control.Label
distance          matlab.ui.control.NumericEditField
Gauge             matlab.ui.control.LinearGauge
Label_12          matlab.ui.control.Label
mLabel            matlab.ui.control.Label
Tar_z_moni        matlab.ui.control.NumericEditField
Tar_y_moni        matlab.ui.control.NumericEditField
Tar_x_moni        matlab.ui.control.NumericEditField
mLabel_2          matlab.ui.control.Label
MS_z_moni         matlab.ui.control.NumericEditField
MS_y_moni         matlab.ui.control.NumericEditField
MS_x_moni         matlab.ui.control.NumericEditField
theta3            matlab.ui.control.NumericEditField
radLabel_6        matlab.ui.control.Label
theta2            matlab.ui.control.NumericEditField
radLabel_5        matlab.ui.control.Label
phi3              matlab.ui.control.NumericEditField
radLabel_3        matlab.ui.control.Label
phi2              matlab.ui.control.NumericEditField
radLabel_2        matlab.ui.control.Label
result_tuoba      matlab.ui.control.NumericEditField
Label_5           matlab.ui.control.Label
result_time       matlab.ui.control.NumericEditField
Label_4           matlab.ui.control.Label
theta1            matlab.ui.control.NumericEditField
radLabel_4        matlab.ui.control.Label
phi1              matlab.ui.control.NumericEditField
radLabel          matlab.ui.control.Label
UIAxes            matlab.ui.control.UIAxes
Tab_4             matlab.ui.container.Tab
TextArea          matlab.ui.control.TextArea
Label_28          matlab.ui.control.Label
Tab_3             matlab.ui.container.Tab
Lamp_2            matlab.ui.control.Lamp
Lamp_2Label       matlab.ui.control.Label
moni_zhuangtai_2  matlab.ui.control.TextArea
Label_46          matlab.ui.control.Label
Panel_4           matlab.ui.container.Panel
Panel_7           matlab.ui.container.Panel
Button_8          matlab.ui.control.Button
Button_7          matlab.ui.control.Button
Button_6          matlab.ui.control.Button
Button_2          matlab.ui.control.Button
T_2               matlab.ui.control.NumericEditField
TsLabel_2         matlab.ui.control.Label
Label_45          matlab.ui.control.Label
Label_44          matlab.ui.control.Label
Label_43          matlab.ui.control.Label
```

```
    Label_42          matlab.ui.control.Label
    Label_41          matlab.ui.control.Label
    Label_40          matlab.ui.control.Label
    Label_39          matlab.ui.control.Label
    Label_38          matlab.ui.control.Label
    Label_37          matlab.ui.control.Label
    Label_36          matlab.ui.control.Label
    Label_35          matlab.ui.control.Label
    Label_34          matlab.ui.control.Label
    Knob_4            matlab.ui.control.DiscreteKnob
    Knob_3            matlab.ui.control.Knob
    Label_33          matlab.ui.control.Label
    dt_2              matlab.ui.control.NumericEditField
    dtsLabel_2        matlab.ui.control.Label
    VmsLabel_2        matlab.ui.control.Label
    v_2               matlab.ui.control.NumericEditField
    MS3mLabel         matlab.ui.control.Label
    MS2mLabel         matlab.ui.control.Label
    MS1mLabel         matlab.ui.control.Label
    MS3_z             matlab.ui.control.NumericEditField
    MS3_y             matlab.ui.control.NumericEditField
    MS3_x             matlab.ui.control.NumericEditField
    MS2_z             matlab.ui.control.NumericEditField
    MS2_y             matlab.ui.control.NumericEditField
    MS2_x             matlab.ui.control.NumericEditField
    MS1_z             matlab.ui.control.NumericEditField
    MS1_y             matlab.ui.control.NumericEditField
    MS1_x             matlab.ui.control.NumericEditField
    Panel_3           matlab.ui.container.Panel
    mLabel_9          matlab.ui.control.Label
    Panel_5           matlab.ui.container.Panel
    mLabel_8          matlab.ui.control.Label
    MS3_z_2           matlab.ui.control.NumericEditField
    MS3_y_2           matlab.ui.control.NumericEditField
    MS3_x_2           matlab.ui.control.NumericEditField
    mLabel_7          matlab.ui.control.Label
    MS2_z_2           matlab.ui.control.NumericEditField
    MS2_y_2           matlab.ui.control.NumericEditField
    MS2_x_2           matlab.ui.control.NumericEditField
    mLabel_5          matlab.ui.control.Label
    Tar2_z            matlab.ui.control.NumericEditField
    Tar2_y            matlab.ui.control.NumericEditField
    Tar2_x            matlab.ui.control.NumericEditField
    mLabel_4          matlab.ui.control.Label
    MS1_z_2           matlab.ui.control.NumericEditField
    MS1_y_2           matlab.ui.control.NumericEditField
    MS1_x_2           matlab.ui.control.NumericEditField
    result_moni_2     matlab.ui.control.EditField
    Label_32          matlab.ui.control.Label
    distance_2        matlab.ui.control.NumericEditField
    Gauge_2           matlab.ui.control.LinearGauge
```

```
        Gauge_2Label      matlab.ui.control.Label
        theta3_2          matlab.ui.control.NumericEditField
        theta2_2          matlab.ui.control.NumericEditField
        phi3_2            matlab.ui.control.NumericEditField
        phi2_2            matlab.ui.control.NumericEditField
        result_time_2     matlab.ui.control.NumericEditField
        Label_30          matlab.ui.control.Label
        theta1_2          matlab.ui.control.NumericEditField
        radLabel_8        matlab.ui.control.Label
        phi1_2            matlab.ui.control.NumericEditField
        radLabel_7        matlab.ui.control.Label
        UIAxes_2          matlab.ui.control.UIAxes
        Tab_5             matlab.ui.container.Tab
        TextArea_2        matlab.ui.control.TextArea
        Label_47          matlab.ui.control.Label
    end
%
%
    properties (Access = private)
        DialogApp % Description
    end
    %公私有属性
    properties (Access = public)
        fig_name = ''; % Description
        fig_type = '';
        tab_name = '';
    end
%私有方法
methods (Access = private)
function main_5(app,MS1,MS2,MS3,v,PT,dt,TTT)
fanwei = 10;
%引爆距离
pred_and_real = [];
%预测
% MS1 = [0 500*sqrt(3) 1000];
% MS2 = [500 -500*sqrt(3) 1000];
% MS3 = [-500 -500*sqrt(3) 1000];      % 3 个导弹的初始位置
% dt = 0.05;          % △t
%设置参数
t = 0;              % 当前时刻
j = 0;
% v = 250;
Target = [];        % 目标的位置
Pred = [];          % 记录每次的目标预测位置
flag = 0;
phi_list = [];
theta_list = [];
app.moni_zhuangtai_2.Value = '正在进行模拟...';
fig = app.UIFigure;
d = uiprogressdlg(fig,'Title','模拟正在推演...','Indeterminate','on');
drawnow;
```

```
while 1
    % 从 t = 0 时刻开始
    xx = 50 * t; yy = 100 * sin(t); zz = cos(t);     % (xx,yy,zz) 目标当前的精确位置
    L = [xx yy zz];
    %
    %% 判断是否击中目标
    if (norm(L-MS1(end,:),2) < 5) || (norm(L-MS2(end,:),2)<5) || (norm(L-MS3(end,:),2)<5)
        flag = 1;
        break;
    end
    %
    if t > TTT
        break;
    end
%
    Target = [Target; L];
%
    %% 计算必要的信息
    x1 = MS1(end,1); y1 = MS1(end,2); z1 = MS1(end,3);
    x2 = MS2(end,1); y2 = MS2(end,2); z2 = MS2(end,3);
    x3 = MS3(end,1); y3 = MS3(end,2); z3 = MS3(end,3);
    r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
    r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
    r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
    r21 = r2 - r1;
    r31 = r3 - r1;
    phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
    theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
    phi_list = [phi_list;phi'];
    theta_list = [theta_list;theta'];
    %% 定位当前的目标位置 (xp,yp,zp)
    [xp,yp,zp] =
pppp(app,[MS1(end,:);MS2(end,:);MS3(end,:)],phi,theta,fanwei,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31
);
    pred = [xp,yp,zp];          % 预测出的当前点坐标
    Pred = [Pred; pred];          % 记录在 Pred 中
%
    pred_and_real = [pred_and_real; xx yy zz pred];
    %
%     zp = 0;
    if j == 0
        MS1_next = MS1(j+1,:) + v*dt*(pred-MS1(j+1,:))/norm(pred-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred-MS2(j+1,:))/norm(pred-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred-MS3(j+1,:))/norm(pred-MS3(j+1,:),2);
    else
        pred_next = 2*Pred(j+1,:)-Pred(j,:);
        MS1_next = MS1(j+1,:) + v*dt*(pred_next-MS1(j+1,:))/norm(pred_next-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred_next-MS2(j+1,:))/norm(pred_next-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred_next-MS3(j+1,:))/norm(pred_next-MS3(j+1,:),2);
    end
    %
```

```
%     max(v*(MS3(j+1,3)/100),100)
    MS1 = [MS1; MS1_next];
    MS2 = [MS2; MS2_next];
    MS3 = [MS3; MS3_next];
    j = j + 1;      % 时刻 + 1
    t = t + dt;
%         plot3(MS1(:,1),MS1(:,2),MS1(:,3),'b--','LineWidth',2);        % 导弹 1
%         hold on;
%         plot3(MS2(:,1),MS2(:,2),MS2(:,3),'b--','LineWidth',2);        % 导弹 2
%         hold on;
%         plot3(MS3(:,1),MS3(:,2),MS3(:,3),'b--','LineWidth',2);        % 导弹 3
%         hold on;
%         plot3(Target(:,1),Target(:,2),Target(:,3),'r--','LineWidth',2);       %目标
%         hold on;
%         draw(xp,yp,zp,10);
%         hold off;
%         grid on;
%         title('动态追踪模型仿真结果示意图');
%         legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%         xlabel('X');
%         ylabel('Y');
%         zlabel('Z');
%         pause(1);
end
%
app.result_time_2.Value = t;
close(d);
if flag == 1
    app.result_moni_2.Value = '成功在限定时间内击中目标！';
else
    app.result_moni_2.Value = '未击中目标！';
end
app.moni_zhuangtai_2.Value = '正在引导绘图...';
%% 绘制击中过程的轨迹图
N = 5;
for i = 1:N
    plot3(app.UIAxes_2,MS1(1:round(j/N*i),1),MS1(1:round(j/N*i),2),MS1(1:round(j/N*i),3),'b-
','LineWidth',2);        % 导弹 1
    app.MS1_x_2.Value = MS1(round(j/N*i),1);
    app.MS1_y_2.Value = MS1(round(j/N*i),2);
    app.MS1_z_2.Value = MS1(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS2(1:round(j/N*i),1),MS2(1:round(j/N*i),2),MS2(1:round(j/N*i),3),'g-
','LineWidth',2);        % 导弹 2
    app.MS2_x_2.Value = MS2(round(j/N*i),1);
    app.MS2_y_2.Value = MS2(round(j/N*i),2);
    app.MS2_z_2.Value = MS2(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS3(1:round(j/N*i),1),MS3(1:round(j/N*i),2),MS3(1:round(j/N*i),3),'m-
','LineWidth',2);        % 导弹 3
    app.MS3_x_2.Value = MS3(round(j/N*i),1);
```

```
    app.MS3_y_2.Value = MS3(round(j/N*i),2);
    app.MS3_z_2.Value = MS3(round(j/N*i),3);
%     hold on;
plot3(app.UIAxes_2,Target(1:round(j/N*i),1),Target(1:round(j/N*i),2),Target(1:round(j/N*i),3),'
r-','LineWidth',2);       % 目标
    app.Tar2_x.Value = Target(round(j/N*i),1);
    app.Tar2_y.Value = Target(round(j/N*i),2);
    app.Tar2_z.Value = Target(round(j/N*i),3);
    dis1 = norm([MS1(round(j/N*i),1) MS1(round(j/N*i),2) MS1(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis2 = norm([MS2(round(j/N*i),1) MS2(round(j/N*i),2) MS2(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis3 = norm([MS3(round(j/N*i),1) MS3(round(j/N*i),2) MS3(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    tmptmp = min([dis1 dis2 dis3]);
    app.distance_2.Value = tmptmp;
%     hold on;
    draw123(app,Target(round(j/N*i),1),Target(round(j/N*i),2),Target(round(j/N*i),3),10);
%     hold off;
%     grid on;
%     title('动态追踪模型仿真结果示意图');
%     legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%     xlabel('X');
%     ylabel('Y');
%     zlabel('Z');
    app.phi1_2.Value = phi_list(round(j/N*i),1);
    app.phi2_2.Value = phi_list(round(j/N*i),2);
    app.phi3_2.Value = phi_list(round(j/N*i),3);
    app.theta1_2.Value = theta_list(round(j/N*i),1);
    app.theta2_2.Value = theta_list(round(j/N*i),2);
    app.theta3_2.Value = theta_list(round(j/N*i),3);
    app.Gauge_2.Value = app.v_2.Value+10*(rand()-0.5);
    if tmptmp>500
        app.Lamp_2.Color = 'g';
    elseif tmptmp>100
        app.Lamp_2.Color = 'b';
    else
        app.Lamp_2.Color = 'm';
    end
    legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
    pause(PT);
end
%
plot3(app.UIAxes_2,MS1(:,1),MS1(:,2),MS1(:,3),'b-','LineWidth',2);        % 导弹 1
% hold on;
plot3(app.UIAxes_2,MS2(:,1),MS2(:,2),MS2(:,3),'g-','LineWidth',2);        % 导弹 2
% hold on;
plot3(app.UIAxes_2,MS3(:,1),MS3(:,2),MS3(:,3),'m-','LineWidth',2);        % 导弹 3
% hold on;
plot3(app.UIAxes_2,Target(:,1),Target(:,2),Target(:,3),'r-','LineWidth',2);       %目标
% hold on;
```

```
% legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹');
draw123(app,Target(end,1),Target(end,2),Target(end,3),10);
app.moni_zhuangtai_2.Value = '绘图完毕';
% hold off;
% grid on;
% title('击中目标! ');
% legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
% xlabel('X');
% ylabel('Y');
% zlabel('Z');
legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
end
function main_4(app,MS1,MS2,MS3,v,PT,dt,TTT)
fanwei = 10;
%引爆距离
pred_and_real = [];
%预测
% MS1 = [0 500*sqrt(3) 1000];
% MS2 = [500 -500*sqrt(3) 1000];
% MS3 = [-500 -500*sqrt(3) 1000];      % 3 个导弹的初始位置
% dt = 0.05;           % △t
%设置参数
t = 0;              % 当前时刻
j = 0;
% v = 250;
Target = [];        % 目标的位置
Pred = [];          % 记录每次的目标预测位置
flag = 0;
phi_list = [];
theta_list = [];
app.moni_zhuangtai_2.Value = '正在进行模拟...';
fig = app.UIFigure;
d = uiprogressdlg(fig,'Title','模拟正在推演...','Indeterminate','on');
drawnow;
while 1
    % 从 t = 0 时刻开始
    xx = 50 * t; yy = 100 * sin(t); zz = cos(t);     % (xx,yy,zz) 目标当前的精确位置
    L = [xx yy zz];
    %
    %% 判断是否击中目标
    if (norm(L-MS1(end,:),2) < 5) || (norm(L-MS2(end,:),2)<5) || (norm(L-MS3(end,:),2)<5)
        flag = 1;
        break;
    end
    %
    if t > TTT
        break;
    end
%
    Target = [Target; L];
%
```

```
    %% 计算必要的信息
    x1 = MS1(end,1); y1 = MS1(end,2); z1 = MS1(end,3);
    x2 = MS2(end,1); y2 = MS2(end,2); z2 = MS2(end,3);
    x3 = MS3(end,1); y3 = MS3(end,2); z3 = MS3(end,3);
    r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
    r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
    r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
    r21 = r2 - r1;
    r31 = r3 - r1;
    phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
    theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
    phi_list = [phi_list;phi'];
    theta_list = [theta_list;theta'];
    %% 定位当前的目标位置 (xp,yp,zp)
    [xp,yp,zp] =
pppp(app,[MS1(end,:);MS2(end,:);MS3(end,:)],phi,theta,fanwei,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31
);
    pred = [xp,yp,zp];          % 预测出的当前点坐标
    Pred = [Pred; pred];          % 记录在 Pred 中
%
    pred_and_real = [pred_and_real; xx yy zz pred];
    %
%     zp = 0;
    if j == 0
        MS1_next = MS1(j+1,:) + v*dt*(pred-MS1(j+1,:))/norm(pred-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred-MS2(j+1,:))/norm(pred-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred-MS3(j+1,:))/norm(pred-MS3(j+1,:),2);
    else
        pred_next = 2*Pred(j+1,:)-Pred(j,:);
        MS1_next = MS1(j+1,:) + v*dt*(pred_next-MS1(j+1,:))/norm(pred_next-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred_next-MS2(j+1,:))/norm(pred_next-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred_next-MS3(j+1,:))/norm(pred_next-MS3(j+1,:),2);
    end
    %
%     max(v*(MS3(j+1,3)/100),100)
    MS1 = [MS1; MS1_next];
    MS2 = [MS2; MS2_next];
    MS3 = [MS3; MS3_next];
    j = j + 1;      % 时刻 + 1
    t = t + dt;
%         plot3(MS1(:,1),MS1(:,2),MS1(:,3),'b--','LineWidth',2);        % 导弹 1
%         hold on;
%         plot3(MS2(:,1),MS2(:,2),MS2(:,3),'b--','LineWidth',2);        % 导弹 2
%         hold on;
%         plot3(MS3(:,1),MS3(:,2),MS3(:,3),'b--','LineWidth',2);        % 导弹 3
%         hold on;
%         plot3(Target(:,1),Target(:,2),Target(:,3),'r--','LineWidth',2);       %目标
%         hold on;
%         draw(xp,yp,zp,10);
%         hold off;
%         grid on;
```

```
%         title('动态追踪模型仿真结果示意图');
%         legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%         xlabel('X');
%         ylabel('Y');
%         zlabel('Z');
%         pause(1);
end
%
app.result_time_2.Value = t;
close(d);
if flag == 1
    app.result_moni_2.Value = '成功在限定时间内击中目标！';
else
    app.result_moni_2.Value = '未击中目标！';
end
app.moni_zhuangtai_2.Value = '正在引导绘图...';
% 绘制击中过程的轨迹图
N = 5;
for i = 1:N
    plot3(app.UIAxes_2,MS1(1:round(j/N*i),1),MS1(1:round(j/N*i),2),MS1(1:round(j/N*i),3),'b-
','LineWidth',2);        % 导弹 1
    app.MS1_x_2.Value = MS1(round(j/N*i),1);
    app.MS1_y_2.Value = MS1(round(j/N*i),2);
    app.MS1_z_2.Value = MS1(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS2(1:round(j/N*i),1),MS2(1:round(j/N*i),2),MS2(1:round(j/N*i),3),'g-
','LineWidth',2);        % 导弹 2
    app.MS2_x_2.Value = MS2(round(j/N*i),1);
    app.MS2_y_2.Value = MS2(round(j/N*i),2);
    app.MS2_z_2.Value = MS2(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS3(1:round(j/N*i),1),MS3(1:round(j/N*i),2),MS3(1:round(j/N*i),3),'m-
','LineWidth',2);        % 导弹 3
    app.MS3_x_2.Value = MS3(round(j/N*i),1);
    app.MS3_y_2.Value = MS3(round(j/N*i),2);
    app.MS3_z_2.Value = MS3(round(j/N*i),3);
%     hold on;
plot3(app.UIAxes_2,Target(1:round(j/N*i),1),Target(1:round(j/N*i),2),Target(1:round(j/N*i),3),'
r-','LineWidth',2);       %目标
    app.Tar2_x.Value = Target(round(j/N*i),1);
    app.Tar2_y.Value = Target(round(j/N*i),2);
    app.Tar2_z.Value = Target(round(j/N*i),3);
    dis1 = norm([MS1(round(j/N*i),1) MS1(round(j/N*i),2) MS1(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis2 = norm([MS2(round(j/N*i),1) MS2(round(j/N*i),2) MS2(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis3 = norm([MS3(round(j/N*i),1) MS3(round(j/N*i),2) MS3(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    tmptmp = min([dis1 dis2 dis3]);
    app.distance_2.Value = tmptmp;
%     hold on;
```

```
    draw123(app,Target(round(j/N*i),1),Target(round(j/N*i),2),Target(round(j/N*i),3),10);
%     hold off;
%     grid on;
%     title('动态追踪模型仿真结果示意图');
%     legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%     xlabel('X');
%     ylabel('Y');
%     zlabel('Z');
    app.phi1_2.Value = phi_list(round(j/N*i),1);
    app.phi2_2.Value = phi_list(round(j/N*i),2);
    app.phi3_2.Value = phi_list(round(j/N*i),3);
    app.theta1_2.Value = theta_list(round(j/N*i),1);
    app.theta2_2.Value = theta_list(round(j/N*i),2);
    app.theta3_2.Value = theta_list(round(j/N*i),3);
    app.Gauge_2.Value = app.v_2.Value+10*(rand()-0.5);
    if tmptmp>500
        app.Lamp_2.Color = 'g';
    elseif tmptmp>100
        app.Lamp_2.Color = 'b';
    else
        app.Lamp_2.Color = 'm';
    end
    legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
    pause(PT);
end
%
plot3(app.UIAxes_2,MS1(:,1),MS1(:,2),MS1(:,3),'b-','LineWidth',2);        % 导弹 1
% hold on;
plot3(app.UIAxes_2,MS2(:,1),MS2(:,2),MS2(:,3),'g-','LineWidth',2);        % 导弹 2
% hold on;
plot3(app.UIAxes_2,MS3(:,1),MS3(:,2),MS3(:,3),'m-','LineWidth',2);        % 导弹 3
% hold on;
plot3(app.UIAxes_2,Target(:,1),Target(:,2),Target(:,3),'r-','LineWidth',2);       %目标
% hold on;
% legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹');
draw123(app,Target(end,1),Target(end,2),Target(end,3),10);
app.moni_zhuangtai_2.Value = '绘图完毕';
% hold off;
% grid on;
% title('击中目标! ');
% legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
% xlabel('X');
% ylabel('Y');
% zlabel('Z');
legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
end
function main_3(app,MS1,MS2,MS3,v,PT,dt,TTT)
fanwei = 10;
%引爆距离
pred_and_real = [];
%预测
```

```
% MS1 = [0 500*sqrt(3) 1000];
% MS2 = [500 -500*sqrt(3) 1000];
% MS3 = [-500 -500*sqrt(3) 1000];      % 3 个导弹的初始位置
% dt = 0.05;           % △t
%设置参数
t = 0;              % 当前时刻
j = 0;
% v = 250;
Target = [];        % 目标的位置
Pred = [];          % 记录每次的目标预测位置
flag = 0;
phi_list = [];
theta_list = [];
app.moni_zhuangtai_2.Value = '正在进行模拟...';
fig = app.UIFigure;
d = uiprogressdlg(fig,'Title','模拟正在推演...','Indeterminate','on');
drawnow;
while 1
    % 从 t = 0 时刻开始
    xx = 50 * t; yy = 100 * sin(t); zz = cos(t);     % (xx,yy,zz) 目标当前的精确位置
    L = [xx yy zz];
    %
    %% 判断是否击中目标
    if (norm(L-MS1(end,:),2) < 5) || (norm(L-MS2(end,:),2)<5) || (norm(L-MS3(end,:),2)<5)
        flag = 1;
        break;
    end
    %
    if t > TTT
        break;
    end
%
    Target = [Target; L];
%
    %% 计算必要的信息
    x1 = MS1(end,1); y1 = MS1(end,2); z1 = MS1(end,3);
    x2 = MS2(end,1); y2 = MS2(end,2); z2 = MS2(end,3);
    x3 = MS3(end,1); y3 = MS3(end,2); z3 = MS3(end,3);
    r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
    r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
    r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
    r21 = r2 - r1;
    r31 = r3 - r1;
    phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
    theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
    phi_list = [phi_list;phi'];
    theta_list = [theta_list;theta'];
    %% 定位当前的目标位置 (xp,yp,zp)
    [xp,yp,zp] =
pppp(app,[MS1(end,:);MS2(end,:);MS3(end,:)],phi,theta,fanwei,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31
);
```

```
    pred = [xp,yp,zp];          % 预测出的当前点坐标
    Pred = [Pred; pred];          % 记录在 Pred 中
%
    pred_and_real = [pred_and_real; xx yy zz pred];
    %
%     zp = 0;
    if j == 0
        MS1_next = MS1(j+1,:) + v*dt*(pred-MS1(j+1,:))/norm(pred-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred-MS2(j+1,:))/norm(pred-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred-MS3(j+1,:))/norm(pred-MS3(j+1,:),2);
    else
        pred_next = 2*Pred(j+1,:)-Pred(j,:);
        MS1_next = MS1(j+1,:) + v*dt*(pred_next-MS1(j+1,:))/norm(pred_next-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred_next-MS2(j+1,:))/norm(pred_next-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred_next-MS3(j+1,:))/norm(pred_next-MS3(j+1,:),2);
    end
    %
%     max(v*(MS3(j+1,3)/100),100)
    MS1 = [MS1; MS1_next];
    MS2 = [MS2; MS2_next];
    MS3 = [MS3; MS3_next];
    j = j + 1;      % 时刻 + 1
    t = t + dt;
%         plot3(MS1(:,1),MS1(:,2),MS1(:,3),'b--','LineWidth',2);        % 导弹 1
%         hold on;
%         plot3(MS2(:,1),MS2(:,2),MS2(:,3),'b--','LineWidth',2);        % 导弹 2
%         hold on;
%         plot3(MS3(:,1),MS3(:,2),MS3(:,3),'b--','LineWidth',2);        % 导弹 3
%         hold on;
%         plot3(Target(:,1),Target(:,2),Target(:,3),'r--','LineWidth',2);       %目标
%         hold on;
%         draw(xp,yp,zp,10);
%         hold off;
%         grid on;
%         title('动态追踪模型仿真结果示意图');
%         legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%         xlabel('X');
%         ylabel('Y');
%         zlabel('Z');
%         pause(1);
end
%
app.result_time_2.Value = t;
close(d);
if flag == 1
    app.result_moni_2.Value = '成功在限定时间内击中目标! ';
else
    app.result_moni_2.Value = '未击中目标! ';
end
app.moni_zhuangtai_2.Value = '正在引导绘图...';
%% 绘制击中过程的轨迹图
```

```
N = 5;
for i = 1:N
    plot3(app.UIAxes_2,MS1(1:round(j/N*i),1),MS1(1:round(j/N*i),2),MS1(1:round(j/N*i),3),'b-
','LineWidth',2);        % 导弹 1
    app.MS1_x_2.Value = MS1(round(j/N*i),1);
    app.MS1_y_2.Value = MS1(round(j/N*i),2);
    app.MS1_z_2.Value = MS1(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS2(1:round(j/N*i),1),MS2(1:round(j/N*i),2),MS2(1:round(j/N*i),3),'g-
','LineWidth',2);        % 导弹 2
    app.MS2_x_2.Value = MS2(round(j/N*i),1);
    app.MS2_y_2.Value = MS2(round(j/N*i),2);
    app.MS2_z_2.Value = MS2(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS3(1:round(j/N*i),1),MS3(1:round(j/N*i),2),MS3(1:round(j/N*i),3),'m-
','LineWidth',2);        % 导弹 3
    app.MS3_x_2.Value = MS3(round(j/N*i),1);
    app.MS3_y_2.Value = MS3(round(j/N*i),2);
    app.MS3_z_2.Value = MS3(round(j/N*i),3);
%     hold on;
plot3(app.UIAxes_2,Target(1:round(j/N*i),1),Target(1:round(j/N*i),2),Target(1:round(j/N*i),3),'
r-','LineWidth',2);       %目标
    app.Tar2_x.Value = Target(round(j/N*i),1);
    app.Tar2_y.Value = Target(round(j/N*i),2);
    app.Tar2_z.Value = Target(round(j/N*i),3);
    dis1 = norm([MS1(round(j/N*i),1) MS1(round(j/N*i),2) MS1(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis2 = norm([MS2(round(j/N*i),1) MS2(round(j/N*i),2) MS2(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis3 = norm([MS3(round(j/N*i),1) MS3(round(j/N*i),2) MS3(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    tmptmp = min([dis1 dis2 dis3]);
    app.distance_2.Value = tmptmp;
%     hold on;
    draw123(app,Target(round(j/N*i),1),Target(round(j/N*i),2),Target(round(j/N*i),3),10);
%     hold off;
%     grid on;
%     title('动态追踪模型仿真结果示意图');
%     legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%     xlabel('X');
%     ylabel('Y');
%     zlabel('Z');
    app.phi1_2.Value = phi_list(round(j/N*i),1);
    app.phi2_2.Value = phi_list(round(j/N*i),2);
    app.phi3_2.Value = phi_list(round(j/N*i),3);
    app.theta1_2.Value = theta_list(round(j/N*i),1);
    app.theta2_2.Value = theta_list(round(j/N*i),2);
    app.theta3_2.Value = theta_list(round(j/N*i),3);
    app.Gauge_2.Value = app.v_2.Value+10*(rand()-0.5);
    if tmptmp>500
        app.Lamp_2.Color = 'g';
```

```
    elseif tmptmp>100
        app.Lamp_2.Color = 'b';
    else
        app.Lamp_2.Color = 'm';
    end
    legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
    pause(PT);
end
%
plot3(app.UIAxes_2,MS1(:,1),MS1(:,2),MS1(:,3),'b-','LineWidth',2);        % 导弹 1
% hold on;
plot3(app.UIAxes_2,MS2(:,1),MS2(:,2),MS2(:,3),'g-','LineWidth',2);        % 导弹 2
% hold on;
plot3(app.UIAxes_2,MS3(:,1),MS3(:,2),MS3(:,3),'m-','LineWidth',2);        % 导弹 3
% hold on;
plot3(app.UIAxes_2,Target(:,1),Target(:,2),Target(:,3),'r-','LineWidth',2);       %目标
% hold on;
% legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹');
draw123(app,Target(end,1),Target(end,2),Target(end,3),10);
app.moni_zhuangtai_2.Value = '绘图完毕';
% hold off;
% grid on;
% title('击中目标! ');
% legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
% xlabel('X');
% ylabel('Y');
% zlabel('Z');
legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
end
function main_10(app,MS1,MS2,MS3,v,PT,dt,TTT)
fanwei = 10;
%引爆距离
pred_and_real = [];
%预测
% MS1 = [0 500*sqrt(3) 1000];
% MS2 = [500 -500*sqrt(3) 1000];
% MS3 = [-500 -500*sqrt(3) 1000];      % 3 个导弹的初始位置
% dt = 0.05;           % △t
%设置参数
t = 0;              % 当前时刻
j = 0;
% v = 250;
Target = [];        % 目标的位置
Pred = [];          % 记录每次的目标预测位置
flag = 0;
phi_list = [];
theta_list = [];
app.moni_zhuangtai_2.Value = '正在进行模拟...';
fig = app.UIFigure;
d = uiprogressdlg(fig,'Title','模拟正在推演...','Indeterminate','on');
drawnow;
```

```
while 1
    % 从 t = 0 时刻开始
    xx = 50 * t; yy = 100 * sin(t); zz = cos(t);     % (xx,yy,zz) 目标当前的精确位置
    L = [xx yy zz];
    %
    %% 判断是否击中目标
    if (norm(L-MS1(end,:),2) < 5) || (norm(L-MS2(end,:),2)<5) || (norm(L-MS3(end,:),2)<5)
        flag = 1;
        break;
    end
    %
    if t > TTT
        break;
    end
%
    Target = [Target; L];
%
    %% 计算必要的信息
    x1 = MS1(end,1); y1 = MS1(end,2); z1 = MS1(end,3);
    x2 = MS2(end,1); y2 = MS2(end,2); z2 = MS2(end,3);
    x3 = MS3(end,1); y3 = MS3(end,2); z3 = MS3(end,3);
    r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
    r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
    r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
    r21 = r2 - r1;
    r31 = r3 - r1;
    phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
    theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
    phi_list = [phi_list;phi'];
    theta_list = [theta_list;theta'];
    %% 定位当前的目标位置 (xp,yp,zp)
    [xp,yp,zp] =
pppp(app,[MS1(end,:);MS2(end,:);MS3(end,:)],phi,theta,fanwei,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31
);
    pred = [xp,yp,zp];          % 预测出的当前点坐标
    Pred = [Pred; pred];          % 记录在 Pred 中
%
    pred_and_real = [pred_and_real; xx yy zz pred];
    %
%     zp = 0;
    if j == 0
        MS1_next = MS1(j+1,:) + v*dt*(pred-MS1(j+1,:))/norm(pred-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred-MS2(j+1,:))/norm(pred-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred-MS3(j+1,:))/norm(pred-MS3(j+1,:),2);
    else
        pred_next = 2*Pred(j+1,:)-Pred(j,:);
        MS1_next = MS1(j+1,:) + v*dt*(pred_next-MS1(j+1,:))/norm(pred_next-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred_next-MS2(j+1,:))/norm(pred_next-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred_next-MS3(j+1,:))/norm(pred_next-MS3(j+1,:),2);
    end
    %
```

```
%     max(v*(MS3(j+1,3)/100),100)
    MS1 = [MS1; MS1_next];
    MS2 = [MS2; MS2_next];
    MS3 = [MS3; MS3_next];
    j = j + 1;      % 时刻 + 1
    t = t + dt;
end
%
app.result_time_2.Value = t;
close(d);
if flag == 1
    app.result_moni_2.Value = '成功在限定时间内击中目标！';
else
    app.result_moni_2.Value = '未击中目标！';
end
app.moni_zhuangtai_2.Value = '正在引导绘图...';
%% 绘制击中过程的轨迹图
N = 5;
end
function main_2(app,MS1,MS2,MS3,v,PT,dt,TTT)
fanwei = 10;
%引爆距离
pred_and_real = [];
%预测
% MS1 = [0 500*sqrt(3) 1000];
% MS2 = [500 -500*sqrt(3) 1000];
% MS3 = [-500 -500*sqrt(3) 1000];      % 3 个导弹的初始位置
% dt = 0.05;           % △t
%设置参数
t = 0;              % 当前时刻
j = 0;
% v = 250;
Target = [];        % 目标的位置
Pred = [];          % 记录每次的目标预测位置
flag = 0;
phi_list = [];
theta_list = [];
app.moni_zhuangtai_2.Value = '正在进行模拟...';
fig = app.UIFigure;
d = uiprogressdlg(fig,'Title','模拟正在推演...','Indeterminate','on');
drawnow;
while 1
    % 从 t = 0 时刻开始
    xx = 50 * t; yy = 100 * sin(t); zz = cos(t);     % (xx,yy,zz) 目标当前的精确位置
    L = [xx yy zz];
    %
    %% 判断是否击中目标
    if (norm(L-MS1(end,:),2) < 5) || (norm(L-MS2(end,:),2)<5) || (norm(L-MS3(end,:),2)<5)
        flag = 1;
        break;
    end
```

```
    %
    if t > TTT
        break;
    end
%
    Target = [Target; L];
%
    %% 计算必要的信息
    x1 = MS1(end,1); y1 = MS1(end,2); z1 = MS1(end,3);
    x2 = MS2(end,1); y2 = MS2(end,2); z2 = MS2(end,3);
    x3 = MS3(end,1); y3 = MS3(end,2); z3 = MS3(end,3);
    r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
    r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
    r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
    r21 = r2 - r1;
    r31 = r3 - r1;
    phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
    theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
    phi_list = [phi_list;phi'];
    theta_list = [theta_list;theta'];
    %% 定位当前的目标位置 (xp,yp,zp)
    [xp,yp,zp] =
pppp(app,[MS1(end,:);MS2(end,:);MS3(end,:)],phi,theta,fanwei,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31
);
    pred = [xp,yp,zp];          % 预测出的当前点坐标
    Pred = [Pred; pred];          % 记录在 Pred 中
%
    pred_and_real = [pred_and_real; xx yy zz pred];
    %
%     zp = 0;
    if j == 0
        MS1_next = MS1(j+1,:) + v*dt*(pred-MS1(j+1,:))/norm(pred-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred-MS2(j+1,:))/norm(pred-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred-MS3(j+1,:))/norm(pred-MS3(j+1,:),2);
    else
        pred_next = 2*Pred(j+1,:)-Pred(j,:);
        MS1_next = MS1(j+1,:) + v*dt*(pred_next-MS1(j+1,:))/norm(pred_next-MS1(j+1,:),2);
        MS2_next = MS2(j+1,:) + v*dt*(pred_next-MS2(j+1,:))/norm(pred_next-MS2(j+1,:),2);
        MS3_next = MS3(j+1,:) + v*dt*(pred_next-MS3(j+1,:))/norm(pred_next-MS3(j+1,:),2);
    end
    %
%     max(v*(MS3(j+1,3)/100),100)
    MS1 = [MS1; MS1_next];
    MS2 = [MS2; MS2_next];
    MS3 = [MS3; MS3_next];
    j = j + 1;      % 时刻 + 1
    t = t + dt;
%         plot3(MS1(:,1),MS1(:,2),MS1(:,3),'b--','LineWidth',2);        % 导弹 1
%         hold on;
%         plot3(MS2(:,1),MS2(:,2),MS2(:,3),'b--','LineWidth',2);        % 导弹 2
%         hold on;
```

```
%         plot3(MS3(:,1),MS3(:,2),MS3(:,3),'b--','LineWidth',2);        % 导弹 3
%         hold on;
%         plot3(Target(:,1),Target(:,2),Target(:,3),'r--','LineWidth',2);       %目标
%         hold on;
%         draw(xp,yp,zp,10);
%         hold off;
%         grid on;
%         title('动态追踪模型仿真结果示意图');
%         legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%         xlabel('X');
%         ylabel('Y');
%         zlabel('Z');
%         pause(1);
end
%
app.result_time_2.Value = t;
close(d);
if flag == 1
    app.result_moni_2.Value = '成功在限定时间内击中目标！';
else
    app.result_moni_2.Value = '未击中目标！';
end
app.moni_zhuangtai_2.Value = '正在引导绘图...';
%% 绘制击中过程的轨迹图
N = 5;
for i = 1:N
    plot3(app.UIAxes_2,MS1(1:round(j/N*i),1),MS1(1:round(j/N*i),2),MS1(1:round(j/N*i),3),'b-
','LineWidth',2);        % 导弹 1
    app.MS1_x_2.Value = MS1(round(j/N*i),1);
    app.MS1_y_2.Value = MS1(round(j/N*i),2);
    app.MS1_z_2.Value = MS1(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS2(1:round(j/N*i),1),MS2(1:round(j/N*i),2),MS2(1:round(j/N*i),3),'g-
','LineWidth',2);        % 导弹 2
    app.MS2_x_2.Value = MS2(round(j/N*i),1);
    app.MS2_y_2.Value = MS2(round(j/N*i),2);
    app.MS2_z_2.Value = MS2(round(j/N*i),3);
%     hold on;
    plot3(app.UIAxes_2,MS3(1:round(j/N*i),1),MS3(1:round(j/N*i),2),MS3(1:round(j/N*i),3),'m-
','LineWidth',2);        % 导弹 3
    app.MS3_x_2.Value = MS3(round(j/N*i),1);
    app.MS3_y_2.Value = MS3(round(j/N*i),2);
    app.MS3_z_2.Value = MS3(round(j/N*i),3);
%     hold on;
plot3(app.UIAxes_2,Target(1:round(j/N*i),1),Target(1:round(j/N*i),2),Target(1:round(j/N*i),3),'
r-','LineWidth',2);       %目标
    app.Tar2_x.Value = Target(round(j/N*i),1);
    app.Tar2_y.Value = Target(round(j/N*i),2);
    app.Tar2_z.Value = Target(round(j/N*i),3);
    dis1 = norm([MS1(round(j/N*i),1) MS1(round(j/N*i),2) MS1(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
```

```
    dis2 = norm([MS2(round(j/N*i),1) MS2(round(j/N*i),2) MS2(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    dis3 = norm([MS3(round(j/N*i),1) MS3(round(j/N*i),2) MS3(round(j/N*i),3)]-
[Target(round(j/N*i),1) Target(round(j/N*i),2) Target(round(j/N*i),3)],2);
    tmptmp = min([dis1 dis2 dis3]);
    app.distance_2.Value = tmptmp;
%     hold on;
    draw123(app,Target(round(j/N*i),1),Target(round(j/N*i),2),Target(round(j/N*i),3),10);
%     hold off;
%     grid on;
%     title('动态追踪模型仿真结果示意图');
%     legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
%     xlabel('X');
%     ylabel('Y');
%     zlabel('Z');
    app.phi1_2.Value = phi_list(round(j/N*i),1);
    app.phi2_2.Value = phi_list(round(j/N*i),2);
    app.phi3_2.Value = phi_list(round(j/N*i),3);
    app.theta1_2.Value = theta_list(round(j/N*i),1);
    app.theta2_2.Value = theta_list(round(j/N*i),2);
    app.theta3_2.Value = theta_list(round(j/N*i),3);
    app.Gauge_2.Value = app.v_2.Value+10*(rand()-0.5);
    if tmptmp>500
        app.Lamp_2.Color = 'g';
    elseif tmptmp>100
        app.Lamp_2.Color = 'b';
    else
        app.Lamp_2.Color = 'm';
    end
    legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
    pause(PT);
end
%
plot3(app.UIAxes_2,MS1(:,1),MS1(:,2),MS1(:,3),'b-','LineWidth',2);        % 导弹 1
% hold on;
plot3(app.UIAxes_2,MS2(:,1),MS2(:,2),MS2(:,3),'g-','LineWidth',2);        % 导弹 2
% hold on;
plot3(app.UIAxes_2,MS3(:,1),MS3(:,2),MS3(:,3),'m-','LineWidth',2);        % 导弹 3
% hold on;
plot3(app.UIAxes_2,Target(:,1),Target(:,2),Target(:,3),'r-','LineWidth',2);       %目标
% hold on;
% legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹');
draw123(app,Target(end,1),Target(end,2),Target(end,3),10);
app.moni_zhuangtai_2.Value = '绘图完毕';
% hold off;
% grid on;
% title('击中目标! ');
% legend('导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹 ','目标运动轨迹');
% xlabel('X');
% ylabel('Y');
% zlabel('Z');
```

```
legend(app.UIAxes_2,'导弹 1 轨迹','导弹 2 轨迹','导弹 3 轨迹','目标轨迹',Location='northwest');
end
%
function [x,y,z,resnorm] =
pppp(app,MS,phi,theta,fanwei,x1_,x2_,x3_,y1_,y2_,y3_,z1_,z2_,z3_,r21,r31)
%     global fanwei;
    x1 = MS(1,1); y1 = MS(1,2); z1 = MS(1,3);
    x2 = MS(2,1); y2 = MS(2,2); z2 = MS(2,3);
    x3 = MS(3,1); y3 = MS(3,2); z3 = MS(3,3);
%
    tmp = find(isnan(theta));           %寻找 theta 中是否有 NaN
    if isempty(tmp)        % 若没有，则正常计算
        AA = cos(phi).*sin(theta);
        BB = cos(phi).*cos(theta);
        CC = sin(phi);
%
        A1 = [BB(1), -AA(1);
              BB(2), -AA(2);
              BB(3), -AA(3)];
        b1 = [BB(1)*x1-AA(1)*y1;
              BB(2)*x2-AA(2)*y2;
              BB(3)*x3-AA(3)*y3];
%
        A2 = [CC(1), -BB(1);
              CC(2), -BB(2);
              CC(3), -BB(3)];
        b2 = [CC(1)*y1-BB(1)*z1;
              CC(2)*y2-BB(2)*z2;
              CC(3)*y3-BB(3)*z3];
%
        XY = A1\b1;
%         XZ = A2\b2;
%
        x = XY(1);
        y = XY(2);
        z01 = CC(1)*(x-x1)/AA(1)+z1;
        z02 = CC(2)*(x-x2)/AA(2)+z2;
        z03 = CC(3)*(x-x3)/AA(3)+z3;
        z04 = CC(1)*(y-y1)/BB(1)+z1;
        z05 = CC(2)*(y-y2)/BB(2)+z2;
        z06 = CC(3)*(y-y3)/BB(3)+z3;
        z0 = (z01+z02+z03+z04+z05+z06)/6;
    else                              % 若有，则 x 和 y 已经确定
        x = mean(MS(tmp,1)); y = mean(MS(tmp,2));
        AA = cos(phi).*sin(theta);
        BB = cos(phi).*cos(theta);
        CC = sin(phi);
        z01 = CC(1)*(x-x1)/AA(1)+z1;
        z02 = CC(2)*(x-x2)/AA(2)+z2;
        z03 = CC(3)*(x-x3)/AA(3)+z3;
        z04 = CC(1)*(y-y1)/BB(1)+z1;
```

```
        z05 = CC(2)*(y-y2)/BB(2)+z2;
        z06 = CC(3)*(y-y3)/BB(3)+z3;
        z0p = [z01;z02;z03;z04;z05;z06];
        notNanValues=z0p(~isnan(z0p));
        z0=sum(notNanValues)./length(notNanValues);
    end
%
    t = [x,y];          % 参数
%
%     t
%     z0
%     phi
%     theta
%
    options.Algorithm = 'levenberg-marquardt';
    if isnan(z0)
        z0 = 0;
    end
%     min_resnorm = +inf;
%     for z0 = linspace(-abs(z0),abs(z0),10)
    [z0x, resnorm1] = lsqnonlin(@(x)
fun13(app,x,t,x1_,x2_,x3_,y1_,y2_,y3_,z1_,z2_,z3_,r21,r31),z0,-fanwei,fanwei,options);
    [z0y, resnorm2] = lsqnonlin(@(x)
fun13(app,x,t,x1_,x2_,x3_,y1_,y2_,y3_,z1_,z2_,z3_,r21,r31),-z0,-fanwei,fanwei,options);
%     [z0z, resnorm3] = lsqnonlin(@(x) fun(x,t),-z0,-fanwei,fanwei,options);
%     [z0z, resnorm3] = lsqnonlin(@(x) fun(x,t),0,-fanwei,fanwei,options);
%
    z = [z0x, z0y];
    resnorm = [resnorm1, resnorm2];
%     if resnorm1 > resnorm2
%         z = z0y; resnorm = resnorm2;
%     else
%         z = z0x; resnorm = resnorm1;
%     end
%     if resnorm < min_resnorm
%         min_resnorm = resnorm;
%         best_z = z;
%     end
%     end
%
    idx = find(resnorm == min(resnorm));
    idx = idx(1);
    resnorm = resnorm(idx);
    z = z(idx);
 %
end
%
%% fun.m
function F = fun13(app,z,t,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31)
    % x 与 y 为已经预测出的变量
%     global x1 x2 x3 y1 y2 y3 z1 z2 z3 r21 r31;
```

```
    x = t(1); y = t(2);
    r1p = ((x1 - x)^2 + (y1 - y)^2 + (z1 - z)^2)^(1/2);
    r2p = ((x2 - x)^2 + (y2 - y)^2 + (z2 - z)^2)^(1/2);
    r3p = ((x3 - x)^2 + (y3 - y)^2 + (z3 - z)^2)^(1/2);
%
    r21p = r2p - r1p;
    r31p = r3p - r1p;
    F(1) = r21p - r21;
    F(2) = r31p - r31;
end
%
%% 以 (x, y, z) 为中心点，作一长方形
function draw123(app,x, y, z, width)
    X = linspace(x-width,x+width,100);
    Y = linspace(y-width,y+width,100);
    Z = linspace(z-width,z+width,100);
%
    [XY,YX] = meshgrid(X,Y);
    [XZ,ZX] = meshgrid(X,Z);
    [YZ,ZY] = meshgrid(Y,Z);
%
    % z = z + 1 / z = z - 1
    [m,n] = size(XY);
    mesh(app.UIAxes_2,XY,YX,ones(m,n) * (z + width));
    mesh(app.UIAxes_2,XY,YX,ones(m,n) * (z - width));
    % y = y + 1 / y = y - 1
    [m,n] = size(XZ);
    mesh(app.UIAxes_2,XZ,ones(m,n) * (y + width),ZX);
    mesh(app.UIAxes_2,XZ,ones(m,n) * (y - width),ZX);
    % x = x + 1 / x = x - 1
    [m,n] = size(YZ);
    mesh(app.UIAxes_2,ones(m,n) * (x + width),YZ,ZY);
    mesh(app.UIAxes_2,ones(m,n) * (x - width),YZ,ZY);
end
    function YYY = main(app,BS1,BS2,MS,v,dt,T,pt)
    %% 坐标相关变量
    %     BS1 = [1000 -500 5];
    %     BS2 = [-500 -500 5];      % 2 个基站
    %     MS = [312 500 312];          % 导弹
        pred_and_real = [];     % 记录每次目标的真实位置与定位的位置
        Target = [];        % 目标的位置
        Pred = [];          % 记录每次的目标预测位置
%
        %% 时间与速度参数
        %dt = 0.05;           % △t
        t = 0;              % 当前时刻
        %T = 50;             % 时间上限
        j = 0;              % 计数器（记录时间单位的数目）
        %v = 250;            % 导弹速度
%
        %% N 阶差分 + 未来多步预测相关变量
```

```
        differ_N = 20;      % 差分的最大阶数
        pre_MAX = 20;         % 超前预测的步数（这里取 pre_N 步）
        idea_MAX = 20;      % 进行理想追踪状态允许的最大步数
%
%
        %% 初始化 D
        D = zeros(differ_N,T/dt,3);      % N 阶差分矩阵（其每个元素都是一个三维的矢量！）
        for i = 1:differ_N
            for k = 1:i
                D(i,k,:) = [NaN NaN NaN];       % 这些位置没有信息（为空）
            end
        end
%
%
        %% 初始化 dt_pow 与 fact 矩阵（之后预测位置要用到！）
        % dt_pow = [];    % 记录 dt^... 的矩阵
        fact = factorial(1:differ_N)';
%
        %% 是否击中目标的标志
        flag = 0;           % 标记是否击中目标
%
        %% L0 位置
        L0 = [2000, 1000, 400];
%
%
        %% 开始模拟仿真
%
        %% ※ 导弹的状态向量
        state.isIdea = 0;       % 当前是否是理想追踪状态
        state.STEP = 0;     % 若是，追踪步数是多少
        phi_list = [];
        theta_list = [];
        app.moni_zhuangtai.Value = '模拟进行中...';
        figgg = app.UIFigure;
        d = uiprogressdlg(figgg,'Title','模拟正在推演...','Indeterminate','on');
        drawnow;
        while 1
            %%导弹当前速度
%             v = v+5*(rand()-0.5);
%             app.Knob.Value = v;
            % 从 t = 0 时刻开始
            L = L0 + [100 * t 200 * cos(t) 200 * sin(t)];          % 更新目标的位置（实际位置）
            xx = L(1); yy = L(2); zz = L(3);
            Target = [Target; L];       % 存入 Target（实际位置）
%
            %% 判断是否击中目标
            R = norm(L-MS(end,:),2);
            if R < 1
                flag = 1;
                break;
            end
```

```
%
            if t > T
                break;
            end
%
            %% 计算必要的信息（观测信息）
            x1 = MS(end,1); y1 = MS(end,2); z1 = MS(end,3);
            x2 = BS1(1); y2 = BS1(2); z2 = BS1(3);
            x3 = BS2(1); y3 = BS2(2); z3 = BS2(3);
            r1 = ((x1 - xx)^2 + (y1 - yy)^2 + (z1 - zz)^2)^(1/2);
            r2 = ((x2 - xx)^2 + (y2 - yy)^2 + (z2 - zz)^2)^(1/2);
            r3 = ((x3 - xx)^2 + (y3 - yy)^2 + (z3 - zz)^2)^(1/2);
            r21 = r2 - r1;
            r31 = r3 - r1;
            phi = asin([(zz-z1)/r1; (zz-z2)/r2; (zz-z3)/r3]);   % 仰角 ϕ
            phi_list = [phi_list;phi'];
%             app.phi1.Value = phi(1);
%             app.phi2.Value = phi(2);
%             app.phi3.Value = phi(3);
            theta = atan([(xx-x1)/(yy-y1); (xx-x2)/(yy-y2); (xx-x3)/(yy-y3)]);  % 方位角 θ
            theta_list = [theta_list;theta'];
%             app.theta1.Value = theta(1);
%             app.theta2.Value = theta(2);
%             app.theta3.Value = theta(3);
            %% 无源定位当前的目标位置 (xf,yf,zf)
            [xf,yf,zf] =
predict_pre(app,[MS(end,:);BS1;BS2],phi,theta,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31);
            pred = [xf,yf,zf];          %**观测**出的当前点坐标
            Pred = [Pred; pred];          %将观测到的当前坐标记录在 Pred 中
            pred_and_real = [pred_and_real; L pred];
%
            %% 预测的距离，即预测出的目标点与导弹当前位置的距离（后续需要根据这个来进行追踪选择）
            RP = norm(pred-MS(end,:),2);
%
            %% 计算差分，更新差分矩阵 D
            JIE = min(j,differ_N);   % 根据 j 与 differ_N 的大小关系，决定最多可以计算几阶差分
%
        %     j
            for k = 1:JIE
                if k == 1       % 第一阶（速度）利用的是位置计算的
                    D(k,j,:) = (Pred(end,:) - Pred(end-1,:))/dt;
                else
                    D(k,j,:) = (D(k-1,j,:)-D(k-1,j-1,:))/dt;
                end
            end
%
            %% 进行（单步 or 多步）预测，并根据预测结果与导弹当前的位置
            %  决定对未来多少步做预测，并且让导弹向着这个方向运动（更新坐标）
            %  在导弹向预测的位置运动时，更新接下来时刻的定位信息，不断修正对该时刻点位置的预测
%
            % 现在已经有的是已有的差分阶数：JIE
```

```
            if JIE == 0         % 即 j == 0 时刻，此时无法预测（没有任何信息）
                pred_next = pred;
            else
                %% 无论如何，都重新筛选一遍理想追踪点，看其是否比当前的**更优**
                %% 即：倾向于更改目标以实现更高效地打击（贪心）
                IdeaThisTurn = 0;   % 记录*本轮*中是否找到理想点
 %
                BACKUP = [];        % 备选点（步数+点坐标）
                std = [];     % ※※距离减小的速率（越大越好！！）
                for step = 1:min(JIE,pre_MAX)    % 枚举预测的步数（从小到大枚举）
                    backup = pre_next(app,pred,JIE,j,step,dt,D,fact);       % 点的预测
                    dist = norm(MS(end,:)-backup,2);   % 计算距离
%
                    %---- step - 1 ---- distance ---- step ----%
                    % 若 (step - 1) 步内就可以到达目标
                    % 但由于预测的是未来 step 步的，因此会飞过掉，所以否决掉 step 步
                    if v*dt*(step-1) >= dist
                        continue;
                    end
 %
                    %% **容易看出：step == 1，即对未来一步进行预测，其必定是属于下面两种情况的其中一种
的！
                    % 因此，不会出现：对所有枚举的 step，都不符合我们的要求的情况
%
                    % 若 (step - 1) 步内无法到达，而 step 步恰好到达
                    % 则就朝着该点方向飞行 step 步即可！（最理想的追踪效果）
                    if step <= idea_MAX && (v*dt*(step-1) < dist) && (dist <= v*dt*step)
                        best = backup;
                        STEP = step;
                        IdeaThisTurn = 1;
                        disp('搜索到理想追踪状态');
                        disp(['对 ', num2str(j+STEP), ' 时刻的位置预测：']);
                        disp('追踪点：');
                        backup
                        disp('超前预测（步）：');
                        STEP
                        break;
                    else
                        % step 步无法到达,即 dist > v*dt*step
                        BACKUP = [BACKUP; step backup];
                        %% 这里很关键！！ 挑选的是 最小的点，效果最好！！
        %                 std = [std; step RP/dist*step];
                        std = [std; step/dist];
                    end
                end
%
                % 结束上面的遍历过程后，决定：
                % ① 保持原理想点（原理想点更好）
                % ② 更换为新的理想点（若原本并非理想追踪状态；或原本的理想点不如现在的好）
                % ③ 原本就非理想状态，而本轮也没有筛出理想点，则选择一个比较好的点做跟踪
                % 筛选最终的：步数+追踪点
```

```
%
%
            if state.isIdea == 1    % 先更新当前的步数，便于接下来的比较
                state.STEP = state.STEP - 1;     % 步数减 1（时刻+1，故步数-1）
            end
%
            if state.isIdea == 1    % 若当前点为理想点
                if IdeaThisTurn == 0 || state.STEP <= STEP
                    %% 不修改理想点，修正追踪目标（顺便检验修正后是否失效，其实可以不加）
                    pred_next = pre_next(app,pred,JIE,j,state.STEP,dt,D,fact);     % 重新做预
测，修正位置
                    pred_next
                    DISTANCE = norm(MS(end,:)-pred_next,2);   % 计算距离
                    v*dt*(state.STEP-1)
                    DISTANCE
                    v*dt*state.STEP
                    if (v*dt*(state.STEP-1) < DISTANCE) && (DISTANCE <= v*dt*state.STEP)
                        %% 若修正目标位置后，依旧满足该条件，则可以继续追踪
                        disp('理想追踪状态有效，无需更换');
                        disp(['对 ', num2str(j+state.STEP), ' 时刻的位置预测：']);
                        d1 = v*dt*(state.STEP-1)
                        DISTANCE
                        RP
                        d2 = v*dt*state.STEP
                    else
                        disp('理想追踪状态失效，需重新更换');
                        state.isIdea = 0;      % 否则，将其置为 0
                    end
                elseif IdeaThisTurn == 1 && state.STEP > STEP
                    %% 更好的理想点，则修改之
                    disp('发现更好的理想点');
                    state.STEP = STEP;      % 更新步数
                    pred_next = best;       % 更新追踪目标
                end
            end
%
            %% 若现在并非理想点状态
            if state.isIdea == 0
                if IdeaThisTurn == 1
                    %% 修改为理想点
                    disp('从非理想点更换为理想点');
                    state.STEP = STEP;      % 更新步数
                    pred_next = best;       % 更新追踪目标
                    state.isIdea = 1;      % ※ 更新状态为理想状态
%
                    disp('追踪目标:');
                    pred_next
                    disp('追踪步数:');
                    state.STEP
                else
                    %% ※ 这里的调整策略可以修改
```

```
                    %% 若没有理想点，挑选出减小速率最大的那个
                    std
                    [value,idx] = max(std);
                    pred_next = BACKUP(idx,2:4);        % 在 BACKUP 中找出对应的点
                end
            end
        end
%
        %% 更新导弹的坐标
        % 如果到目标的预测距离（注：是预测距离！）已经小于以火箭速度飞行 dt 的距离了，则不必按 v 继续飞行，而是直接飞到目标点即可（可以看作熄火飞行）
        if norm(MS(end,:)-pred_next,2) < v*dt
            MS1_next = pred_next;
        else
            MS1_next = MS(end,:) + v*dt*(pred_next-MS(end,:))/norm(pred_next-MS(end,:),2);
        end
%
        MS = [MS; MS1_next];
%
        %% 更新时刻
        j = j + 1;      % 时刻 + 1
        t = t + dt;     % 时间 + dt
    end
%
    app.result_time.Value = t;
%       disp('花费时间为(s)：'); t
%
        if flag == 1
            app.result_tuoba.Value = R;
        end
%           disp('击中目标');
%           disp('脱靶量为(m)：'); R
%       else
%           disp('未击中目标');
%       end
    close(d);
    app.moni_zhuangtai.Value = '模拟推演完毕，开始引导绘图...';
    drawing(app,MS,Target,j,flag,BS1,BS2,pt,phi_list,theta_list);
end
%
%% 绘图的程序（对 z 轴的值做平滑化处理，使曲线更美观）
% MS：导弹轨迹，Target：目标轨迹，T：总时间，flag：是否击中
function drawing(app,MS,Target,T,flag,BS1,BS2,pt,phi_list,theta_list)
%
%    MS(:,1) = smooth(MS(:,1));      % 平滑化（但不会在外面修改 MS）
%    MS(:,2) = smooth(MS(:,2));      % 平滑化（但不会在外面修改 MS）
%    MS(:,3) = smooth(MS(:,3));      % 平滑化（但不会在外面修改 MS）
%   theta_list
    app.Gauge.Value = 0;
    % 绘制击中过程的轨迹图
    N = 10;
```

```
        if T >= N
            for i = 1:N
    %            hold off;
%
plot3(app.UIAxes,MS(1:round(T/N*i),1),MS(1:round(T/N*i),2),MS(1:round(T/N*i),3),'b--
','LineWidth',1.5);   % 导弹轨迹
                app.MS_x_moni.Value = MS(round(T/N*i),1);
                app.MS_y_moni.Value = MS(round(T/N*i),2);
                app.MS_z_moni.Value = MS(round(T/N*i),3);
                app.Tar_x_moni.Value = Target(round(T/N*i),1);
                app.Tar_y_moni.Value = Target(round(T/N*i),2);
                app.Tar_z_moni.Value = Target(round(T/N*i),3);
                app.distance.Value = norm([MS(round(T/N*i),1) MS(round(T/N*i),2)
MS(round(T/N*i),3)]-[Target(round(T/N*i),1) Target(round(T/N*i),2) Target(round(T/N*i),3)],2);
                if app.distance.Value>500
                    app.Lamp.Color = 'g';
                elseif app.distance.Value>100
                    app.Lamp.Color = 'b';
                else
                    app.Lamp.Color = 'm';
                end
    %            hold on;
%
plot3(app.UIAxes,Target(1:round(T/N*i),1),Target(1:round(T/N*i),2),Target(1:round(T/N*i),3),'r-
','LineWidth',1.5);       %目标轨迹
    %            hold on;
%
plot3(app.UIAxes,Target(round(T/N*i),1),Target(round(T/N*i),2),Target(round(T/N*i),3),'r^','Lin
eWidth',1.5);    % 目标当前位置
    %            hold on;
                plot3(app.UIAxes,BS1(1),BS1(2),BS1(3),'g^','LineWidth',1.5);        % 基站 1
    %            hold on;
                plot3(app.UIAxes,BS2(1),BS2(2),BS2(3),'m^','LineWidth',1.5);        % 基站 2
                legend(app.UIAxes,'导弹轨迹','目标轨迹','目标','基站 1','基站
2',Location='northwest');
    %            hold on;
    %            grid on;
    %            title('动态追踪模型仿真结果示意图');
    %            legend('导弹轨迹','目标运动轨迹','目标','基站 1','基站 2');
    %            xlabel('X');
    %            ylabel('Y');
    %            zlabel('Z');
%
            app.theta1.Value = theta_list(i,1);
            app.theta2.Value = theta_list(i,2);
            app.theta3.Value = theta_list(i,3);
%
            app.phi1.Value = phi_list(i,1);
            app.phi2.Value = phi_list(i,2);
            app.phi3.Value = phi_list(i,3);
%
```

```
            app.Gauge.Value = app.v.Value+20*(rand()-0.5);
                pause(pt);
            end
            app.moni_zhuangtai.Value = '绘图完毕！';
        end
%
    %     hold off;
        %% 最终绘制结果图
        h1 = plot3(app.UIAxes,MS(:,1),MS(:,2),MS(:,3),'b--','LineWidth',1.5);        % 导弹轨迹
    %     hold on;
        h2 = plot3(app.UIAxes,Target(:,1),Target(:,2),Target(:,3),'r-','LineWidth',1.5);       %
目标轨迹
    %     hold on;
        h3 =
plot3(app.UIAxes,Target(end,1),Target(end,2),Target(end,3),'r^','LineWidth',1.5);    % 目标
    %     hold on;
        h4 = plot3(app.UIAxes,MS(end,1),MS(end,2),MS(end,3),'bx','LineWidth',1.5);        % 导弹
    %     hold on;
        h5 = plot3(app.UIAxes,BS1(1),BS1(2),BS1(3),'g^','LineWidth',1.5);        % 基站 1
    %     hold on;
        h6 = plot3(app.UIAxes,BS2(1),BS2(2),BS2(3),'m^','LineWidth',1.5);        % 基站 2
%         leg1 = legend(app.UIAxes,h1,'导弹轨迹');
%         leg2 = legend(app.UIAxes,h2,'目标轨迹');
%         leg4 = legend(app.UIAxes,h4,'导弹');
%         leg3 = legend(app.UIAxes,h3,'目标');
%         leg5 = legend(app.UIAxes,h5,'基站 1');
%         leg6 = legend(app.UIAxes,h6,'基站 2');
        legend(app.UIAxes,'导弹轨迹','目标轨迹','目标','基站 1','基站 2');
    %     hold on;
    %     grid on;
        if flag == 1
            app.result_moni.Value = '成功击中目标！';
        else
            app.result_moni.Value = '未在限定时间内击中目标！';
        end
    %     legend('导弹轨迹','目标运动轨迹','目标','导弹','基站 1','基站 2');
    %     xlabel('X');
    %     ylabel('Y');
    %     zlabel('Z');
    end
%
    %% 计算 (n*dt)^(1~differ_N) 的矩阵
    function POW = dt_pow(app,n,JIE,dt)
        POW = (n*dt).^(1:JIE);
        POW = POW';
    end
%
    function F = funfun(app,z,t,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31)
%
        x = t(1); y = t(2);
        r1p = ((x1 - x)^2 + (y1 - y)^2 + (z1 - z)^2)^(1/2);
```

```
        r2p = ((x2 - x)^2 + (y2 - y)^2 + (z2 - z)^2)^(1/2);
        r3p = ((x3 - x)^2 + (y3 - y)^2 + (z3 - z)^2)^(1/2);
%
        r21p = r2p - r1p;
        r31p = r3p - r1p;
        F(1) = r21p - r21;
        F(2) = r31p - r31;
    end
%
    %% 对未来的预测位置进行预测
    % JIE 是当前能使用的差分阶数，决定了能用几阶计算（越大越好），step 是预测未来的几步
    % 此函数传入的参数要求必须满足： JIE >= step
    % j：当前是 j 时刻
    %% 即：在 j 时刻，用 JIE 阶展开做 step 步预测
    function p = pre_next(app,L,JIE,j,step,dt,D,fact)
        p = L + sum(reshape(D(1:JIE,j,:),JIE,3).*dt_pow(app,step,JIE,dt)./fact(1:JIE),1);
    end
%
    function [x,y,z,resnorm] = predict_pre(app,MS,phi,theta,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31)
        x1_ = MS(1,1); y1_ = MS(1,2); z1_ = MS(1,3);
        x2_ = MS(2,1); y2_ = MS(2,2); z2_ = MS(2,3);
        x3_ = MS(3,1); y3_ = MS(3,2); z3_ = MS(3,3);
%
        tmp = find(isnan(theta));           %寻找 theta 中是否有 NaN
        if isempty(tmp)        % 若没有，则正常计算
            AA = cos(phi).*sin(theta);
            BB = cos(phi).*cos(theta);
            CC = sin(phi);
%
            A1 = [BB(1), -AA(1);
                  BB(2), -AA(2);
                  BB(3), -AA(3)];
            b1 = [BB(1)*x1_-AA(1)*y1_;
                  BB(2)*x2_-AA(2)*y2_;
                  BB(3)*x3_-AA(3)*y3_];
%
            A2 = [CC(1), -BB(1);
                  CC(2), -BB(2);
                  CC(3), -BB(3)];
            b2 = [CC(1)*y1_-BB(1)*z1_;
                  CC(2)*y2_-BB(2)*z2_;
                  CC(3)*y3_-BB(3)*z3_];
%
            XY = A1\b1;
    %         XZ = A2\b2;
%
            x = XY(1);
            y = XY(2);
            z01 = CC(1)*(x-x1_)/AA(1)+z1_;
            z02 = CC(2)*(x-x2_)/AA(2)+z2_;
            z03 = CC(3)*(x-x3_)/AA(3)+z3_;
```

```
            z04 = CC(1)*(y-y1_)/BB(1)+z1_;
            z05 = CC(2)*(y-y2_)/BB(2)+z2_;
            z06 = CC(3)*(y-y3_)/BB(3)+z3_;
            z0 = (z01+z02+z03+z04+z05+z06)/6;
        else                            % 若有，则 x 和 y 已经确定
            tmp
            x = mean(MS(tmp,1)); y = mean(MS(tmp,2));
            x
            y
            AA = cos(phi).*sin(theta);
            BB = cos(phi).*cos(theta);
            CC = sin(phi);
            z01 = CC(1)*(x-x1_)/AA(1)+z1_;
            z02 = CC(2)*(x-x2_)/AA(2)+z2_;
            z03 = CC(3)*(x-x3_)/AA(3)+z3_;
            z04 = CC(1)*(y-y1_)/BB(1)+z1_;
            z05 = CC(2)*(y-y2_)/BB(2)+z2_;
            z06 = CC(3)*(y-y3_)/BB(3)+z3_;
            z0p = [z01;z02;z03;z04;z05;z06];
            notNanValues=z0p(~isnan(z0p));
            z0=sum(notNanValues)./length(notNanValues);
        end
%
        t = [x,y];          % 参数
%
        options.Algorithm = 'levenberg-marquardt';
        options.Display = 'off';
        if isnan(z0) || z0 == inf ||  z0 == -inf
            z0 = 0;
        end
%
    %     z0
    %     t
        [z0x,resnorm1] = lsqnonlin(@(x)
funfun(app,x,t,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31),z0,[],[],options);
        [z0y,resnorm2] = lsqnonlin(@(x) funfun(app,x,t,x1,x2,x3,y1,y2,y3,z1,z2,z3,r21,r31),-
z0,[],[],options);
%
        z = [z0x,z0y];
        resnorm = [resnorm1,resnorm2];
%
        idx = find(resnorm == min(resnorm));
        idx = idx(1);
        resnorm = resnorm(idx);
        z = z(idx);
    end
end
%
    methods (Access = public)
%
        function  updateData(app,name,type,tablename)
```

```
            app.fig_name = name;
            app.fig_type = type;
            app.tab_name = tablename;
%             ux = app.UIAxes;
%             p = plot(ux,magic(5));
%             fig1 = figure;
%             ax = axes;
%             copyobj(ux.Children,ax);
%             saveas(fig1,strcat(strcat('C:\',app.fig_name),strcat('.',app.fig_type)));
            app.moni_zhuangtai.Value = strcat(strcat(tablename,'.xlsx、
'),strcat(strcat(app.fig_name,'.'),strcat(app.fig_type,'已保存到当前路径')));
            app.moni_zhuangtai_2.Value = strcat(strcat(tablename,'.xlsx、
'),strcat(strcat(app.fig_name,'.'),strcat(app.fig_type,'已保存到当前路径')));
        end
    end
%
    % Callbacks that handle component events
    methods (Access = private)
        % Button pushed function: Button
        function ButtonPushed(app, event)
            cla(app.UIAxes);
            app.moni_zhuangtai.Value = '模拟开始进行...';
            BS1 = [app.BS1_x.Value,app.BS1_y.Value,app.BS1_z.Value];
            BS2 = [app.BS2_x.Value,app.BS2_y.Value,app.BS2_z.Value];
            MS = [app.MS_x.Value,app.MS_y.Value,app.MS_z.Value];
%
            if strcmp(app.Knob_2.Value,'Fast')
                PT = 0.25;
            elseif strcmp(app.Knob_2.Value,'Quick')
                PT = 0.5;
            elseif strcmp(app.Knob_2.Value,'Medium')
                PT = 1;
            else
                PT = 1.5;
            end
            V = app.v.Value;
            DT = app.dt.Value;
            TT = app.T.Value;
%             figgg = app.UIFigure;
%             d = uiprogressdlg(figgg,'Title','模拟正在推演...','Indeterminate','on');
%             drawnow;
            main(app,BS1,BS2,MS,V,DT,TT,PT);
%             close(d);
            app.moni_zhuangtai.Value = '本次模拟顺利结束！';
        end
%
        % Value changed function: v
        function vValueChanged(app, event)
            value = app.v.Value;
            app.Knob.Value = value;
        end
```

```
%
        % Value changing function: Knob
        function KnobValueChanging(app, event)
            changingValue = event.Value;
            app.v.Value = changingValue;
        end
%
        % Button pushed function: Button_2
        function Button_2Pushed(app, event)
            cla(app.UIAxes_2);
            app.moni_zhuangtai_2.Value = '开始模拟多弹协同定位追踪...';
            MS1 = [app.MS1_x.Value,app.MS1_y.Value,app.MS1_z.Value];
            MS2 = [app.MS2_x.Value,app.MS2_y.Value,app.MS2_z.Value];
            MS3 = [app.MS3_x.Value,app.MS3_y.Value,app.MS3_z.Value];
            VV = app.v_2.Value;
            DTT = app.dt_2.Value;
            if strcmp(app.Knob_4.Value,'Fast')
                PT = 0.25;
            elseif strcmp(app.Knob_4.Value,'Quick')
                PT = 0.5;
            elseif strcmp(app.Knob_4.Value,'Medium')
                PT = 1;
            else
                PT = 1.5;
            end
            TTT = app.T_2.Value;
            main_2(app,MS1,MS2,MS3,VV,PT,DTT,TTT);
            app.moni_zhuangtai_2.Value = '本次模拟顺利结束！';
        end
%
        % Value changed function: v_2
        function v_2ValueChanged(app, event)
            value = app.v_2.Value;
            app.Knob_3.Value = value;
        end
%
        % Value changing function: Knob_3
        function Knob_3ValueChanging(app, event)
            changingValue = event.Value;
            app.v_2.Value = changingValue;
        end
%
        % Button pushed function: Button_3
        function Button_3Pushed(app, event)
            app.DialogApp = AuxApp(app,app.fig_name,app.fig_type);
        end
%
        % Button pushed function: Button_4
        function Button_4Pushed(app, event)
            cla(app.UIAxes);
            app.BS1_x.Value = 1000;
```

```
            app.BS1_y.Value = -500;
            app.BS1_z.Value = 5;
            app.BS2_x.Value = -500;
            app.BS2_y.Value = -500;
            app.BS2_z.Value = 5;
            app.MS_x.Value = 0;
            app.MS_y.Value = 500;
            app.MS_z.Value = 5;
            app.v.Value = 250;
            app.dt.Value = 0.05;
            app.Knob.Value = 250;
            app.T.Value = 50;
            app.moni_zhuangtai.Value = '请耐心等待模拟完毕！';
            app.Lamp.Color = 'k';
        end
%
        % Button pushed function: Button_5
        function Button_5Pushed(app, event)
            delete(app);
        end
%
        % Button pushed function: Button_7
        function Button_7Pushed(app, event)
            cla(app.UIAxes_2);
            app.MS1_x.Value = 0;
            app.MS1_y.Value = 866.025;
            app.MS1_z.Value = 1000;
            app.MS2_x.Value = 500;
            app.MS2_y.Value = -866.025;
            app.MS2_z.Value = 1000;
            app.MS3_x.Value = -500;
            app.MS3_y.Value = -866.025;
            app.MS3_z.Value = 1000;
            app.T_2.Value = 50;
            app.v_2.Value = 250;
            app.dt_2.Value = 0.05;
            app.Knob_3.Value = 250;
            app.moni_zhuangtai_2.Value = '请耐心等待模拟推演完毕！';
            app.Lamp_2.Color = 'k';
        end
%
        % Button pushed function: Button_8
        function Button_8Pushed(app, event)
            delete(app);
        end
%
        % Button pushed function: Button_6
        function Button_6Pushed(app, event)
            app.DialogApp = test5_aux(app,app.fig_name,app.fig_type);
        end
    end
```

```
%
    % Component initialization
    methods (Access = private)
%
        % Create UIFigure and components
        function createComponents(app)
%
            % Create UIFigure and hide until all components are created
            app.UIFigure = uifigure('Visible', 'off');
            app.UIFigure.Position = [100 100 1165 548];
            app.UIFigure.Name = 'MATLAB App';
%
            % Create TabGroup2
            app.TabGroup2 = uitabgroup(app.UIFigure);
            app.TabGroup2.TabLocation = 'left';
            app.TabGroup2.Position = [5 6 1158 494];
%
            % Create Tab_2
            app.Tab_2 = uitab(app.TabGroup2);
            app.Tab_2.Title = '单弹追踪';
%
            % Create UIAxes
            app.UIAxes = uiaxes(app.Tab_2);
            title(app.UIAxes, '单弹目标追踪动态轨迹图')
            xlabel(app.UIAxes, 'X')
            ylabel(app.UIAxes, 'Y')
            zlabel(app.UIAxes, 'Z')
            app.UIAxes.View = [15.2548828125 38.2861328125];
            app.UIAxes.Projection = 'perspective';
            app.UIAxes.FontName = 'Adobe 宋体 Std L';
            app.UIAxes.XColor = [0 0 0];
            app.UIAxes.ZColor = [0 0.4471 0.7412];
            app.UIAxes.XGrid = 'on';
            app.UIAxes.YGrid = 'on';
            app.UIAxes.ZGrid = 'on';
            app.UIAxes.FontSize = 12;
            app.UIAxes.SortMethod = 'depth';
            app.UIAxes.NextPlot = 'add';
            colormap(app.UIAxes, 'colorcube')
            app.UIAxes.Position = [18 59 516 426];
%
            % Create Panel
            app.Panel = uipanel(app.Tab_2);
            app.Panel.ForegroundColor = [0 0.4471 0.7412];
            app.Panel.Title = '模拟状态信息';
            app.Panel.Position = [542 6 526 221];
%
            % Create radLabel
            app.radLabel = uilabel(app.Panel);
            app.radLabel.FontWeight = 'bold';
            app.radLabel.Position = [9 170 71 22];
```

```
            app.radLabel.Text = '仰角 ϕ1(rad)';
%
            % Create phi1
            app.phi1 = uieditfield(app.Panel, 'numeric');
            app.phi1.ValueDisplayFormat = '%.3f';
            app.phi1.Editable = 'off';
            app.phi1.HorizontalAlignment = 'center';
            app.phi1.Position = [80 170 48 22];
%
            % Create radLabel_4
            app.radLabel_4 = uilabel(app.Panel);
            app.radLabel_4.FontWeight = 'bold';
            app.radLabel_4.Position = [6 129 81 22];
            app.radLabel_4.Text = '方位角 θ1(rad)';
%
            % Create theta1
            app.theta1 = uieditfield(app.Panel, 'numeric');
            app.theta1.ValueDisplayFormat = '%.3f';
            app.theta1.Editable = 'off';
            app.theta1.HorizontalAlignment = 'center';
            app.theta1.Position = [84 129 48 22];
%
            % Create Label_4
            app.Label_4 = uilabel(app.Panel);
            app.Label_4.HorizontalAlignment = 'right';
            app.Label_4.FontWeight = 'bold';
            app.Label_4.Position = [45 52 68 22];
            app.Label_4.Text = '模拟耗时(s)';
%
            % Create result_time
            app.result_time = uieditfield(app.Panel, 'numeric');
            app.result_time.ValueDisplayFormat = '%.3f';
            app.result_time.Editable = 'off';
            app.result_time.HorizontalAlignment = 'center';
            app.result_time.Position = [140 52 74 22];
%
            % Create Label_5
            app.Label_5 = uilabel(app.Panel);
            app.Label_5.HorizontalAlignment = 'right';
            app.Label_5.FontWeight = 'bold';
            app.Label_5.Position = [43 15 60 22];
            app.Label_5.Text = '脱靶量(m)';
%
            % Create result_tuoba
            app.result_tuoba = uieditfield(app.Panel, 'numeric');
            app.result_tuoba.ValueDisplayFormat = '%.3f';
            app.result_tuoba.Editable = 'off';
            app.result_tuoba.HorizontalAlignment = 'center';
            app.result_tuoba.Position = [140 15 74 22];
%
            % Create radLabel_2
```

```
            app.radLabel_2 = uilabel(app.Panel);
            app.radLabel_2.FontWeight = 'bold';
            app.radLabel_2.Position = [133 170 71 22];
            app.radLabel_2.Text = '仰角 ϕ2(rad)';
%
            % Create phi2
            app.phi2 = uieditfield(app.Panel, 'numeric');
            app.phi2.ValueDisplayFormat = '%.3f';
            app.phi2.Editable = 'off';
            app.phi2.HorizontalAlignment = 'center';
            app.phi2.Position = [204 169 48 22];
%
            % Create radLabel_3
            app.radLabel_3 = uilabel(app.Panel);
            app.radLabel_3.FontWeight = 'bold';
            app.radLabel_3.Position = [260 169 71 22];
            app.radLabel_3.Text = '仰角 ϕ3(rad)';
%
            % Create phi3
            app.phi3 = uieditfield(app.Panel, 'numeric');
            app.phi3.ValueDisplayFormat = '%.3f';
            app.phi3.Editable = 'off';
            app.phi3.HorizontalAlignment = 'center';
            app.phi3.Position = [331 169 48 22];
%
            % Create radLabel_5
            app.radLabel_5 = uilabel(app.Panel);
            app.radLabel_5.FontWeight = 'bold';
            app.radLabel_5.Position = [135 129 81 22];
            app.radLabel_5.Text = '方位角 θ2(rad)';
%
            % Create theta2
            app.theta2 = uieditfield(app.Panel, 'numeric');
            app.theta2.ValueDisplayFormat = '%.3f';
            app.theta2.Editable = 'off';
            app.theta2.HorizontalAlignment = 'center';
            app.theta2.Position = [213 129 48 22];
%
            % Create radLabel_6
            app.radLabel_6 = uilabel(app.Panel);
            app.radLabel_6.FontWeight = 'bold';
            app.radLabel_6.Position = [264 129 81 22];
            app.radLabel_6.Text = '方位角 θ3(rad)';
%
            % Create theta3
            app.theta3 = uieditfield(app.Panel, 'numeric');
            app.theta3.ValueDisplayFormat = '%.3f';
            app.theta3.Editable = 'off';
            app.theta3.HorizontalAlignment = 'center';
            app.theta3.Position = [341 129 48 22];
%
```

```
            % Create MS_x_moni
            app.MS_x_moni = uieditfield(app.Panel, 'numeric');
            app.MS_x_moni.ValueDisplayFormat = '%.2f';
            app.MS_x_moni.Editable = 'off';
            app.MS_x_moni.HorizontalAlignment = 'center';
            app.MS_x_moni.Position = [326 89 54 22];
%
            % Create MS_y_moni
            app.MS_y_moni = uieditfield(app.Panel, 'numeric');
            app.MS_y_moni.ValueDisplayFormat = '%.2f';
            app.MS_y_moni.Tag = 'BS1_y';
            app.MS_y_moni.Editable = 'off';
            app.MS_y_moni.HorizontalAlignment = 'center';
            app.MS_y_moni.Position = [388 89 59 22];
%
            % Create MS_z_moni
            app.MS_z_moni = uieditfield(app.Panel, 'numeric');
            app.MS_z_moni.ValueDisplayFormat = '%.2f';
            app.MS_z_moni.Editable = 'off';
            app.MS_z_moni.HorizontalAlignment = 'center';
            app.MS_z_moni.Position = [459 89 48 22];
%
            % Create mLabel_2
            app.mLabel_2 = uilabel(app.Panel);
            app.mLabel_2.FontWeight = 'bold';
            app.mLabel_2.Position = [226 89 96 22];
            app.mLabel_2.Text = '导弹实时坐标(m)';
%
            % Create Tar_x_moni
            app.Tar_x_moni = uieditfield(app.Panel, 'numeric');
            app.Tar_x_moni.ValueDisplayFormat = '%.2f';
            app.Tar_x_moni.Editable = 'off';
            app.Tar_x_moni.HorizontalAlignment = 'center';
            app.Tar_x_moni.Position = [327 52 54 22];
%
            % Create Tar_y_moni
            app.Tar_y_moni = uieditfield(app.Panel, 'numeric');
            app.Tar_y_moni.ValueDisplayFormat = '%.2f';
            app.Tar_y_moni.Tag = 'BS1_y';
            app.Tar_y_moni.Editable = 'off';
            app.Tar_y_moni.HorizontalAlignment = 'center';
            app.Tar_y_moni.Position = [389 52 59 22];
%
            % Create Tar_z_moni
            app.Tar_z_moni = uieditfield(app.Panel, 'numeric');
            app.Tar_z_moni.ValueDisplayFormat = '%.2f';
            app.Tar_z_moni.Editable = 'off';
            app.Tar_z_moni.HorizontalAlignment = 'center';
            app.Tar_z_moni.Position = [460 52 48 22];
%
            % Create mLabel
```

```
            app.mLabel = uilabel(app.Panel);
            app.mLabel.FontWeight = 'bold';
            app.mLabel.Position = [230 52 96 22];
            app.mLabel.Text = '目标实时坐标(m)';
%
            % Create Label_12
            app.Label_12 = uilabel(app.Panel);
            app.Label_12.HorizontalAlignment = 'center';
            app.Label_12.FontWeight = 'bold';
            app.Label_12.Position = [420 126 77 22];
            app.Label_12.Text = '导弹实时速度';
%
            % Create Gauge
            app.Gauge = uigauge(app.Panel, 'linear');
            app.Gauge.Limits = [0 500];
            app.Gauge.FontSize = 9;
            app.Gauge.Position = [398 147 119 40];
            app.Gauge.Value = 250;
%
            % Create distance
            app.distance = uieditfield(app.Panel, 'numeric');
            app.distance.ValueDisplayFormat = '%.3f';
            app.distance.Editable = 'off';
            app.distance.HorizontalAlignment = 'center';
            app.distance.Position = [161 89 54 22];
%
            % Create mLabel_3
            app.mLabel_3 = uilabel(app.Panel);
            app.mLabel_3.FontWeight = 'bold';
            app.mLabel_3.Position = [14 89 144 22];
            app.mLabel_3.Text = '导弹与目标的实时距离(m)';
%
            % Create Label_3
            app.Label_3 = uilabel(app.Panel);
            app.Label_3.HorizontalAlignment = 'right';
            app.Label_3.FontWeight = 'bold';
            app.Label_3.Position = [231 15 53 22];
            app.Label_3.Text = '模拟结果';
%
            % Create result_moni
            app.result_moni = uieditfield(app.Panel, 'text');
            app.result_moni.Editable = 'off';
            app.result_moni.HorizontalAlignment = 'center';
            app.result_moni.Position = [296 15 211 22];
            app.result_moni.Value = '显示是否击中目标';
%
            % Create Label_14
            app.Label_14 = uilabel(app.Tab_2);
            app.Label_14.HorizontalAlignment = 'right';
            app.Label_14.FontWeight = 'bold';
            app.Label_14.Position = [335 20 77 22];
```

```
            app.Label_14.Text = '导弹状态指示';
%
            % Create Lamp
            app.Lamp = uilamp(app.Tab_2);
            app.Lamp.Position = [427 21 20 20];
            app.Lamp.Color = [0 0 0];
%
            % Create Label_15
            app.Label_15 = uilabel(app.Tab_2);
            app.Label_15.HorizontalAlignment = 'right';
            app.Label_15.FontWeight = 'bold';
            app.Label_15.FontColor = [0.149 0.149 0.149];
            app.Label_15.Position = [29 20 53 22];
            app.Label_15.Text = '模拟状态';
%
            % Create moni_zhuangtai
            app.moni_zhuangtai = uitextarea(app.Tab_2);
            app.moni_zhuangtai.Editable = 'off';
            app.moni_zhuangtai.FontWeight = 'bold';
            app.moni_zhuangtai.FontColor = [0 0.4471 0.7412];
            app.moni_zhuangtai.Position = [92 20 220 23];
            app.moni_zhuangtai.Value = {'请耐心等待模拟推演完毕！'};
%
            % Create Panel_2
            app.Panel_2 = uipanel(app.Tab_2);
            app.Panel_2.ForegroundColor = [0 0.4471 0.7412];
            app.Panel_2.Title = '超参数设置';
            app.Panel_2.FontWeight = 'bold';
            app.Panel_2.Position = [541 245 527 240];
%
            % Create BS1_x
            app.BS1_x = uieditfield(app.Panel_2, 'numeric');
            app.BS1_x.ValueDisplayFormat = '%.2f';
            app.BS1_x.HorizontalAlignment = 'center';
            app.BS1_x.Position = [31 160 54 22];
            app.BS1_x.Value = 1000;
%
            % Create BS1_y
            app.BS1_y = uieditfield(app.Panel_2, 'numeric');
            app.BS1_y.ValueDisplayFormat = '%.2f';
            app.BS1_y.Tag = 'BS1_y';
            app.BS1_y.HorizontalAlignment = 'center';
            app.BS1_y.Position = [96 160 59 22];
            app.BS1_y.Value = -500;
%
            % Create BS1_z
            app.BS1_z = uieditfield(app.Panel_2, 'numeric');
            app.BS1_z.ValueDisplayFormat = '%.2f';
            app.BS1_z.HorizontalAlignment = 'center';
            app.BS1_z.Position = [167 160 48 22];
            app.BS1_z.Value = 5;
```

```
%
        % Create BS2_x
        app.BS2_x = uieditfield(app.Panel_2, 'numeric');
        app.BS2_x.ValueDisplayFormat = '%.2f';
        app.BS2_x.HorizontalAlignment = 'center';
        app.BS2_x.Position = [31 107 54 22];
        app.BS2_x.Value = -500;
%
        % Create BS2_y
        app.BS2_y = uieditfield(app.Panel_2, 'numeric');
        app.BS2_y.ValueDisplayFormat = '%.2f';
        app.BS2_y.Tag = 'BS1_y';
        app.BS2_y.HorizontalAlignment = 'center';
        app.BS2_y.Position = [96 107 59 22];
        app.BS2_y.Value = -500;
%
        % Create BS2_z
        app.BS2_z = uieditfield(app.Panel_2, 'numeric');
        app.BS2_z.ValueDisplayFormat = '%.2f';
        app.BS2_z.HorizontalAlignment = 'center';
        app.BS2_z.Position = [167 107 48 22];
        app.BS2_z.Value = 5;
%
        % Create MS_x
        app.MS_x = uieditfield(app.Panel_2, 'numeric');
        app.MS_x.ValueDisplayFormat = '%.2f';
        app.MS_x.HorizontalAlignment = 'center';
        app.MS_x.Position = [31 60 54 22];
%
        % Create MS_y
        app.MS_y = uieditfield(app.Panel_2, 'numeric');
        app.MS_y.ValueDisplayFormat = '%.2f';
        app.MS_y.Tag = 'BS1_y';
        app.MS_y.HorizontalAlignment = 'center';
        app.MS_y.Position = [96 60 59 22];
        app.MS_y.Value = 500;
%
        % Create MS_z
        app.MS_z = uieditfield(app.Panel_2, 'numeric');
        app.MS_z.ValueDisplayFormat = '%.2f';
        app.MS_z.HorizontalAlignment = 'center';
        app.MS_z.Position = [167 60 48 22];
        app.MS_z.Value = 5;
%
        % Create BS1mLabel
        app.BS1mLabel = uilabel(app.Panel_2);
        app.BS1mLabel.FontWeight = 'bold';
        app.BS1mLabel.Position = [16 189 102 22];
        app.BS1mLabel.Text = '基站 1 坐标 BS1(m)';
%
        % Create BS2mLabel
```

```
            app.BS2mLabel = uilabel(app.Panel_2);
            app.BS2mLabel.FontWeight = 'bold';
            app.BS2mLabel.Position = [16 131 102 22];
            app.BS2mLabel.Text = '基站 2 坐标 BS2(m)';
%
            % Create MSmLabel
            app.MSmLabel = uilabel(app.Panel_2);
            app.MSmLabel.FontWeight = 'bold';
            app.MSmLabel.Position = [16 85 114 22];
            app.MSmLabel.Text = '导弹初始坐标 MS(m)';
%
            % Create v
            app.v = uieditfield(app.Panel_2, 'numeric');
            app.v.ValueDisplayFormat = '%.2f';
            app.v.ValueChangedFcn = createCallbackFcn(app, @vValueChanged, true);
            app.v.HorizontalAlignment = 'center';
            app.v.Position = [313 60 48 22];
            app.v.Value = 250;
%
            % Create VmsLabel
            app.VmsLabel = uilabel(app.Panel_2);
            app.VmsLabel.FontWeight = 'bold';
            app.VmsLabel.Position = [247 60 66 22];
            app.VmsLabel.Text = '速度 V(m/s)';
%
            % Create dtsLabel
            app.dtsLabel = uilabel(app.Panel_2);
            app.dtsLabel.FontWeight = 'bold';
            app.dtsLabel.Position = [210 21 103 22];
            app.dtsLabel.Text = '模拟时间间隔 dt(s)';
%
            % Create dt
            app.dt = uieditfield(app.Panel_2, 'numeric');
            app.dt.ValueDisplayFormat = '%.2f';
            app.dt.HorizontalAlignment = 'center';
            app.dt.Position = [314 21 48 22];
            app.dt.Value = 0.05;
%
            % Create TsLabel
            app.TsLabel = uilabel(app.Panel_2);
            app.TsLabel.FontWeight = 'bold';
            app.TsLabel.Position = [16 21 99 22];
            app.TsLabel.Text = '期待捕获时间 T(s)';
%
            % Create T
            app.T = uieditfield(app.Panel_2, 'numeric');
            app.T.ValueDisplayFormat = '%.2f';
            app.T.HorizontalAlignment = 'center';
            app.T.Position = [119 21 48 22];
            app.T.Value = 50;
%
```

```
            % Create Label_29
            app.Label_29 = uilabel(app.Panel_2);
            app.Label_29.FontWeight = 'bold';
            app.Label_29.Position = [410 89 65 22];
            app.Label_29.Text = '图片刷新率';
%
            % Create Knob
            app.Knob = uiknob(app.Panel_2, 'continuous');
            app.Knob.Limits = [0 343];
            app.Knob.ValueChangingFcn = createCallbackFcn(app, @KnobValueChanging, true);
            app.Knob.Position = [274 112 60 60];
            app.Knob.Value = 250;
%
            % Create Knob_2
            app.Knob_2 = uiknob(app.Panel_2, 'discrete');
            app.Knob_2.Items = {'Fast', 'Quick', 'Medium', 'Slow'};
            app.Knob_2.Position = [409 112 60 60];
            app.Knob_2.Value = 'Fast';
%
            % Create Label_16
            app.Label_16 = uilabel(app.Panel_2);
            app.Label_16.Position = [16 60 16 22];
            app.Label_16.Text = '（';
%
            % Create Label_17
            app.Label_17 = uilabel(app.Panel_2);
            app.Label_17.Position = [217 60 10 22];
            app.Label_17.Text = '）';
%
            % Create Label_18
            app.Label_18 = uilabel(app.Panel_2);
            app.Label_18.FontWeight = 'bold';
            app.Label_18.Position = [87 60 10 22];
            app.Label_18.Text = ', ';
%
            % Create Label_19
            app.Label_19 = uilabel(app.Panel_2);
            app.Label_19.FontWeight = 'bold';
            app.Label_19.Position = [160 60 10 22];
            app.Label_19.Text = ', ';
%
            % Create Label_20
            app.Label_20 = uilabel(app.Panel_2);
            app.Label_20.FontWeight = 'bold';
            app.Label_20.Position = [86 107 10 22];
            app.Label_20.Text = ', ';
%
            % Create Label_21
            app.Label_21 = uilabel(app.Panel_2);
            app.Label_21.FontWeight = 'bold';
            app.Label_21.Position = [160 107 10 22];
```

```
            app.Label_21.Text = ', ';
%
            % Create Label_22
            app.Label_22 = uilabel(app.Panel_2);
            app.Label_22.Position = [16 107 16 22];
            app.Label_22.Text = ' (';
%
            % Create Label_23
            app.Label_23 = uilabel(app.Panel_2);
            app.Label_23.Position = [217 107 10 22];
            app.Label_23.Text = ') ';
%
            % Create Label_24
            app.Label_24 = uilabel(app.Panel_2);
            app.Label_24.Position = [16 160 16 22];
            app.Label_24.Text = ' (';
%
            % Create Label_25
            app.Label_25 = uilabel(app.Panel_2);
            app.Label_25.FontWeight = 'bold';
            app.Label_25.Position = [87 160 10 22];
            app.Label_25.Text = ', ';
%
            % Create Label_26
            app.Label_26 = uilabel(app.Panel_2);
            app.Label_26.FontWeight = 'bold';
            app.Label_26.Position = [160 160 10 22];
            app.Label_26.Text = ', ';
%
            % Create Label_27
            app.Label_27 = uilabel(app.Panel_2);
            app.Label_27.Position = [217 160 10 22];
            app.Label_27.Text = ') ';
%
            % Create Panel_6
            app.Panel_6 = uipanel(app.Panel_2);
            app.Panel_6.Position = [394 5 128 84];
%
            % Create Button
            app.Button = uibutton(app.Panel_6, 'push');
            app.Button.ButtonPushedFcn = createCallbackFcn(app, @ButtonPushed, true);
            app.Button.BackgroundColor = [0.0745 0.6235 1];
            app.Button.FontWeight = 'bold';
            app.Button.FontColor = [1 1 1];
            app.Button.Position = [6 55 116 24];
            app.Button.Text = '开始模拟单弹追踪';
%
            % Create Button_3
            app.Button_3 = uibutton(app.Panel_6, 'push');
            app.Button_3.ButtonPushedFcn = createCallbackFcn(app, @Button_3Pushed, true);
            app.Button_3.BackgroundColor = [0.0745 0.6235 1];
```

```
            app.Button_3.FontWeight = 'bold';
            app.Button_3.FontColor = [1 1 1];
            app.Button_3.Position = [6 30 116 24];
            app.Button_3.Text = '保存本次模拟数据';
%
            % Create Button_4
            app.Button_4 = uibutton(app.Panel_6, 'push');
            app.Button_4.ButtonPushedFcn = createCallbackFcn(app, @Button_4Pushed, true);
            app.Button_4.BackgroundColor = [0.0745 0.6235 1];
            app.Button_4.FontWeight = 'bold';
            app.Button_4.FontColor = [1 1 1];
            app.Button_4.Position = [7 5 56 24];
            app.Button_4.Text = '复位';
%
            % Create Button_5
            app.Button_5 = uibutton(app.Panel_6, 'push');
            app.Button_5.ButtonPushedFcn = createCallbackFcn(app, @Button_5Pushed, true);
            app.Button_5.BackgroundColor = [0.0745 0.6235 1];
            app.Button_5.FontWeight = 'bold';
            app.Button_5.FontColor = [1 1 1];
            app.Button_5.Position = [67 5 54 24];
            app.Button_5.Text = '退出';
%
            % Create Tab_4
            app.Tab_4 = uitab(app.TabGroup2);
            app.Tab_4.Title = '使用手册 1';
%
            % Create Label_28
            app.Label_28 = uilabel(app.Tab_4);
            app.Label_28.BackgroundColor = [0.0745 0.6235 1];
            app.Label_28.FontSize = 15;
            app.Label_28.FontWeight = 'bold';
            app.Label_28.FontColor = [1 1 1];
            app.Label_28.Position = [18 460 1046 25];
            app.Label_28.Text = '单弹追踪模拟使用说明';
%
            % Create TextArea
            app.TextArea = uitextarea(app.Tab_4);
            app.TextArea.Editable = 'off';
            app.TextArea.FontSize = 17;
            app.TextArea.Position = [18 3 1046 458];
            app.TextArea.Value = {'说明详情：本段文字围绕“基于 chan 算法和最小二乘优化的动态目标追踪模型仿真计算器”，介绍其使用说明，旨在阐明其使用方法，指明如何使用该软件进行一次单弹追踪仿真模拟实验。';
''; '一、在初次打开软件时，在“单弹追踪”栏下，在“超参数设置”面板中，预设了一次 demo 超参数值，可无需改动超参数值，点击蓝色按钮“开始模拟单弹追踪”，即可进行一次模拟。'; ''; '二、超参数设置面板说明'; '在右上方的超参数设置面板中，共计 12 个超参数可供调整，下面依次说明其含义。'; '（1）基站 1 坐标 BS1（m）：填写三个双精度浮点值分别对应在模拟中用于导弹定位的、编号为 1 的基站的 x、y、z 坐标值。'; '（2）基站 2 坐标 BS2（m）：填写三个双精度浮点值分别对应在模拟中用于导弹定位的、编号为 2 的基站的 x、y、z 坐标值。'; '（3）导弹初始坐标 MS（m）：填写三个双精度浮点值分别对应在模拟中导弹初始位置的 x、y、z 坐标值。'; '（4）期待捕获时间 T（s）：指某次模拟中，导弹被设置的最大追踪时间，超过此时间阈值表示，未能在预计时间追踪到目标，此时，可适当增大其值，以实现在预期时间内成功捕获目标。'; '（5）模拟时间间隔 dt（s）：指模拟中设置的时间步
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长，建议不调整该参数值，若要调整，取值范围为[0.1,1]（s）。'; '（6）速度 v（m/s）：指模拟中导弹的最大速度值，标量，取值范围为[0,343]（m/s），可转动旋钮取值，也可在编辑框中输入数值调整其值。'; '（7）图片刷新率：指在某次模拟完成后，展示模拟过程时在左侧的图框中展示图片的速率。'; '（8）开始模拟单弹追踪：点击即可以上述的超参量数值进行一次模拟实验，并观察结果，模拟状态信息说明见三。'; '（9）保存本次模拟数据：点击即可保存本次模拟的数据文件，包括完整的过程图像以及包含导弹和目标的状态信息的 excel 文件。'; '（10）复位：将擦除本次模拟图像，并修改超参数设置面板中的可调参数为初始的 demo 值（图像刷新速率不会被复位）。'; '（11）退出：退出软件。'; ''; '三、模拟状态信息面板说明'; '在右下方的模拟状态信息面板中，共计 17 个模拟状态信息值用于显示，下面依次说明其含义。'; '（1）仰角 φ1、φ2、φ3（rad）：其值是指导弹在某一时刻分别相对于基站 1、基站 2、目标的仰角，为弧度制。'; '（2）方位角 θ1、θ2、θ3（rad）：其值是指导弹在某一时刻分别相对于基站 1、基站 2、目标的方位角，为弧度制。'; '（3）导弹实时速度（m/s）：其值是指导弹在某一时刻的瞬时速度。'; '（4）导弹与目标的实时距离（m）：其值是指在某一时刻，导弹和目标之间的绝对距离。'; '（5）导弹实时坐标、目标实时坐标（m）：分别表示导弹和目标的实时位置坐标。'; '（6）模拟耗时（s）：其值表示自模拟开始进行直至模拟推演完毕并完成绘图所经历的时间。'; '（7）脱靶量（m）：其值表示导弹在最后一个时刻距离目标的位置。'; ''; '四、左下角模拟状态说明'; '（1）模拟状态中的文本显示当前模拟的进度。'; '（2）导弹状态为“绿色”，表示导弹与目标的距离超过 500m，为“蓝色”表示导弹与目标的距离在 100m 和 500m 之间，为“红色”，表示目标被击毁，距离在导弹引爆范围内。'; ''; '五、左上角图框说明'; '（1）图中展示的是单弹追踪某次模拟的动态过程，可以点击另存为保存模拟图片，可以长按左键并移动转移视角。'; '（2）标签可以拖动以便观察完整的模拟过程。'};
%
            % Create Tab_3
            app.Tab_3 = uitab(app.TabGroup2);
            app.Tab_3.Title = '多弹协同';
%
            % Create UIAxes_2
            app.UIAxes_2 = uiaxes(app.Tab_3);
            title(app.UIAxes_2, '多弹协同定位目标追踪动态轨迹图')
            xlabel(app.UIAxes_2, 'X')
            ylabel(app.UIAxes_2, 'Y')
            zlabel(app.UIAxes_2, 'Z')
            app.UIAxes_2.View = [15.2548828125 38.2861328125];
            app.UIAxes_2.Projection = 'perspective';
            app.UIAxes_2.FontName = 'Adobe 宋体 Std L';
            app.UIAxes_2.XColor = [0 0 0];
            app.UIAxes_2.ZColor = [0 0.4471 0.7412];
            app.UIAxes_2.XGrid = 'on';
            app.UIAxes_2.YGrid = 'on';
            app.UIAxes_2.ZGrid = 'on';
            app.UIAxes_2.FontSize = 12;
            app.UIAxes_2.SortMethod = 'depth';
            app.UIAxes_2.NextPlot = 'add';
            colormap(app.UIAxes_2, 'colorcube')
            app.UIAxes_2.Position = [548 66 509 418];
%
            % Create Panel_3
            app.Panel_3 = uipanel(app.Tab_3);
            app.Panel_3.ForegroundColor = [0 0.4471 0.7412];
            app.Panel_3.Title = '模拟状态信息';
            app.Panel_3.Position = [7 9 535 221];
%
            % Create radLabel_7
            app.radLabel_7 = uilabel(app.Panel_3);
```

```
            app.radLabel_7.FontWeight = 'bold';
            app.radLabel_7.Position = [7 169 105 22];
            app.radLabel_7.Text = '仰角 ϕ1,ϕ2,ϕ3(rad)';
%
            % Create phi1_2
            app.phi1_2 = uieditfield(app.Panel_3, 'numeric');
            app.phi1_2.ValueDisplayFormat = '%.3f';
            app.phi1_2.Editable = 'off';
            app.phi1_2.HorizontalAlignment = 'center';
            app.phi1_2.Position = [111 169 48 22];
%
            % Create radLabel_8
            app.radLabel_8 = uilabel(app.Panel_3);
            app.radLabel_8.FontWeight = 'bold';
            app.radLabel_8.Position = [264 169 112 22];
            app.radLabel_8.Text = '方位角 θ1,θ2,θ3(rad)';
%
            % Create theta1_2
            app.theta1_2 = uieditfield(app.Panel_3, 'numeric');
            app.theta1_2.ValueDisplayFormat = '%.3f';
            app.theta1_2.Editable = 'off';
            app.theta1_2.HorizontalAlignment = 'center';
            app.theta1_2.Position = [377 169 48 22];
%
            % Create Label_30
            app.Label_30 = uilabel(app.Panel_3);
            app.Label_30.HorizontalAlignment = 'right';
            app.Label_30.FontWeight = 'bold';
            app.Label_30.Position = [8 15 68 22];
            app.Label_30.Text = '模拟耗时(s)';
%
            % Create result_time_2
            app.result_time_2 = uieditfield(app.Panel_3, 'numeric');
            app.result_time_2.ValueDisplayFormat = '%.3f';
            app.result_time_2.Editable = 'off';
            app.result_time_2.HorizontalAlignment = 'center';
            app.result_time_2.Position = [90 16 131 22];
%
            % Create phi2_2
            app.phi2_2 = uieditfield(app.Panel_3, 'numeric');
            app.phi2_2.ValueDisplayFormat = '%.3f';
            app.phi2_2.Editable = 'off';
            app.phi2_2.HorizontalAlignment = 'center';
            app.phi2_2.Position = [162 169 48 22];
%
            % Create phi3_2
            app.phi3_2 = uieditfield(app.Panel_3, 'numeric');
            app.phi3_2.ValueDisplayFormat = '%.3f';
            app.phi3_2.Editable = 'off';
            app.phi3_2.HorizontalAlignment = 'center';
            app.phi3_2.Position = [213 169 48 22];
```

```
%
            % Create theta2_2
            app.theta2_2 = uieditfield(app.Panel_3, 'numeric');
            app.theta2_2.ValueDisplayFormat = '%.3f';
            app.theta2_2.Editable = 'off';
            app.theta2_2.HorizontalAlignment = 'center';
            app.theta2_2.Position = [429 169 48 22];
%
            % Create theta3_2
            app.theta3_2 = uieditfield(app.Panel_3, 'numeric');
            app.theta3_2.ValueDisplayFormat = '%.3f';
            app.theta3_2.Editable = 'off';
            app.theta3_2.HorizontalAlignment = 'center';
            app.theta3_2.Position = [480 169 48 22];
%
            % Create Gauge_2Label
            app.Gauge_2Label = uilabel(app.Panel_3);
            app.Gauge_2Label.HorizontalAlignment = 'center';
            app.Gauge_2Label.FontWeight = 'bold';
            app.Gauge_2Label.Position = [79 94 77 22];
            app.Gauge_2Label.Text = '导弹实时速度';
%
            % Create Gauge_2
            app.Gauge_2 = uigauge(app.Panel_3, 'linear');
            app.Gauge_2.Limits = [0 500];
            app.Gauge_2.FontSize = 9;
            app.Gauge_2.Position = [10 112 216 40];
            app.Gauge_2.Value = 250;
%
            % Create distance_2
            app.distance_2 = uieditfield(app.Panel_3, 'numeric');
            app.distance_2.ValueDisplayFormat = '%.3f';
            app.distance_2.Editable = 'off';
            app.distance_2.HorizontalAlignment = 'center';
            app.distance_2.Position = [92 58 130 22];
            app.distance_2.Value = Inf;
%
            % Create Label_32
            app.Label_32 = uilabel(app.Panel_3);
            app.Label_32.HorizontalAlignment = 'right';
            app.Label_32.FontWeight = 'bold';
            app.Label_32.Position = [236 14 53 22];
            app.Label_32.Text = '模拟结果';
%
            % Create result_moni_2
            app.result_moni_2 = uieditfield(app.Panel_3, 'text');
            app.result_moni_2.Editable = 'off';
            app.result_moni_2.HorizontalAlignment = 'center';
            app.result_moni_2.Position = [300 15 229 22];
            app.result_moni_2.Value = '显示是否击中目标';
%
```

```
            % Create Panel_5
            app.Panel_5 = uipanel(app.Panel_3);
            app.Panel_5.Position = [236 51 292 114];
%
            % Create MS1_x_2
            app.MS1_x_2 = uieditfield(app.Panel_5, 'numeric');
            app.MS1_x_2.ValueDisplayFormat = '%.2f';
            app.MS1_x_2.Editable = 'off';
            app.MS1_x_2.HorizontalAlignment = 'center';
            app.MS1_x_2.Position = [107 57 54 22];
%
            % Create MS1_y_2
            app.MS1_y_2 = uieditfield(app.Panel_5, 'numeric');
            app.MS1_y_2.ValueDisplayFormat = '%.2f';
            app.MS1_y_2.Tag = 'BS1_y';
            app.MS1_y_2.Editable = 'off';
            app.MS1_y_2.HorizontalAlignment = 'center';
            app.MS1_y_2.Position = [167 57 59 22];
%
            % Create MS1_z_2
            app.MS1_z_2 = uieditfield(app.Panel_5, 'numeric');
            app.MS1_z_2.ValueDisplayFormat = '%.2f';
            app.MS1_z_2.Editable = 'off';
            app.MS1_z_2.HorizontalAlignment = 'center';
            app.MS1_z_2.Position = [232 57 48 22];
%
            % Create mLabel_4
            app.mLabel_4 = uilabel(app.Panel_5);
            app.mLabel_4.FontWeight = 'bold';
            app.mLabel_4.Position = [8 57 103 22];
            app.mLabel_4.Text = '导弹 1 实时坐标(m)';
%
            % Create Tar2_x
            app.Tar2_x = uieditfield(app.Panel_5, 'numeric');
            app.Tar2_x.ValueDisplayFormat = '%.2f';
            app.Tar2_x.Editable = 'off';
            app.Tar2_x.HorizontalAlignment = 'center';
            app.Tar2_x.Position = [107 81 54 22];
            % Create Tar2_y
            app.Tar2_y = uieditfield(app.Panel_5, 'numeric');
            app.Tar2_y.ValueDisplayFormat = '%.2f';
            app.Tar2_y.Tag = 'BS1_y';
            app.Tar2_y.Editable = 'off';
            app.Tar2_y.HorizontalAlignment = 'center';
            app.Tar2_y.Position = [167 81 59 22];
            % Create Tar2_z
            app.Tar2_z = uieditfield(app.Panel_5, 'numeric');
            app.Tar2_z.ValueDisplayFormat = '%.2f';
            app.Tar2_z.Editable = 'off';
            app.Tar2_z.HorizontalAlignment = 'center';
            app.Tar2_z.Position = [232 81 48 22];
```

```
% Create mLabel_5
app.mLabel_5 = uilabel(app.Panel_5);
app.mLabel_5.FontWeight = 'bold';
app.mLabel_5.Position = [13 84 96 16];
app.mLabel_5.Text = '目标实时坐标(m)';
% Create MS2_x_2
app.MS2_x_2 = uieditfield(app.Panel_5, 'numeric');
app.MS2_x_2.ValueDisplayFormat = '%.2f';
app.MS2_x_2.Editable = 'off';
app.MS2_x_2.HorizontalAlignment = 'center';
app.MS2_x_2.Position = [107 33 54 22];
% Create MS2_y_2
app.MS2_y_2 = uieditfield(app.Panel_5, 'numeric');
app.MS2_y_2.ValueDisplayFormat = '%.2f';
app.MS2_y_2.Tag = 'BS1_y';
app.MS2_y_2.Editable = 'off';
app.MS2_y_2.HorizontalAlignment = 'center';
app.MS2_y_2.Position = [167 33 59 22];
% Create MS2_z_2
app.MS2_z_2 = uieditfield(app.Panel_5, 'numeric');
app.MS2_z_2.ValueDisplayFormat = '%.2f';
app.MS2_z_2.Editable = 'off';
app.MS2_z_2.HorizontalAlignment = 'center';
app.MS2_z_2.Position = [232 33 48 22];
% Create mLabel_7
app.mLabel_7 = uilabel(app.Panel_5);
app.mLabel_7.FontWeight = 'bold';
app.mLabel_7.Position = [8 33 103 22];
app.mLabel_7.Text = '导弹 2 实时坐标(m)';
% Create MS3_x_2
app.MS3_x_2 = uieditfield(app.Panel_5, 'numeric');
app.MS3_x_2.ValueDisplayFormat = '%.2f';
app.MS3_x_2.Editable = 'off';
app.MS3_x_2.HorizontalAlignment = 'center';
app.MS3_x_2.Position = [107 9 54 22];
% Create MS3_y_2
app.MS3_y_2 = uieditfield(app.Panel_5, 'numeric');
app.MS3_y_2.ValueDisplayFormat = '%.2f';
app.MS3_y_2.Tag = 'BS1_y';
app.MS3_y_2.Editable = 'off';
app.MS3_y_2.HorizontalAlignment = 'center';
app.MS3_y_2.Position = [167 8 59 22];
% Create MS3_z_2
app.MS3_z_2 = uieditfield(app.Panel_5, 'numeric');
app.MS3_z_2.ValueDisplayFormat = '%.2f';
app.MS3_z_2.Editable = 'off';
app.MS3_z_2.HorizontalAlignment = 'center';
app.MS3_z_2.Position = [232 7 48 22];
% Create mLabel_8
app.mLabel_8 = uilabel(app.Panel_5);
app.mLabel_8.FontWeight = 'bold';
```

```
app.mLabel_8.Position = [8 9 103 22];
app.mLabel_8.Text = '导弹 3 实时坐标(m)';
% Create mLabel_9
app.mLabel_9 = uilabel(app.Panel_3);
app.mLabel_9.FontWeight = 'bold';
app.mLabel_9.Position = [15 58 70 22];
app.mLabel_9.Text = '最优距离(m)';
% Create Panel_4
app.Panel_4 = uipanel(app.Tab_3);
app.Panel_4.ForegroundColor = [0 0.4471 0.7412];
app.Panel_4.Title = '超参数设置';
app.Panel_4.FontWeight = 'bold';
app.Panel_4.Position = [6 248 536 240];
% Create MS1_x
app.MS1_x = uieditfield(app.Panel_4, 'numeric');
app.MS1_x.ValueDisplayFormat = '%.2f';
app.MS1_x.HorizontalAlignment = 'center';
app.MS1_x.Position = [31 160 54 22];
% Create MS1_y
app.MS1_y = uieditfield(app.Panel_4, 'numeric');
app.MS1_y.ValueDisplayFormat = '%.2f';
app.MS1_y.Tag = 'BS1_y';
app.MS1_y.HorizontalAlignment = 'center';
app.MS1_y.Position = [96 160 59 22];
app.MS1_y.Value = 866.025;
% Create MS1_z
app.MS1_z = uieditfield(app.Panel_4, 'numeric');
app.MS1_z.ValueDisplayFormat = '%.2f';
app.MS1_z.HorizontalAlignment = 'center';
app.MS1_z.Position = [167 160 48 22];
app.MS1_z.Value = 1000;
% Create MS2_x
app.MS2_x = uieditfield(app.Panel_4, 'numeric');
app.MS2_x.ValueDisplayFormat = '%.2f';
app.MS2_x.HorizontalAlignment = 'center';
app.MS2_x.Position = [31 107 54 22];
app.MS2_x.Value = 500;
% Create MS2_y
app.MS2_y = uieditfield(app.Panel_4, 'numeric');
app.MS2_y.ValueDisplayFormat = '%.2f';
app.MS2_y.Tag = 'BS1_y';
app.MS2_y.HorizontalAlignment = 'center';
app.MS2_y.Position = [96 107 59 22];
app.MS2_y.Value = -866.025;
% Create MS2_z
app.MS2_z = uieditfield(app.Panel_4, 'numeric');
app.MS2_z.ValueDisplayFormat = '%.2f';
app.MS2_z.HorizontalAlignment = 'center';
app.MS2_z.Position = [167 107 48 22];
app.MS2_z.Value = 1000;
% Create MS3_x
```

```
app.MS3_x = uieditfield(app.Panel_4, 'numeric');
app.MS3_x.ValueDisplayFormat = '%.2f';
app.MS3_x.HorizontalAlignment = 'center';
app.MS3_x.Position = [31 60 54 22];
app.MS3_x.Value = -500;
% Create MS3_y
app.MS3_y = uieditfield(app.Panel_4, 'numeric');
app.MS3_y.ValueDisplayFormat = '%.2f';
app.MS3_y.Tag = 'BS1_y';
app.MS3_y.HorizontalAlignment = 'center';
app.MS3_y.Position = [96 60 59 22];
app.MS3_y.Value = -866.025;
% Create MS3_z
app.MS3_z = uieditfield(app.Panel_4, 'numeric');
app.MS3_z.ValueDisplayFormat = '%.2f';
app.MS3_z.HorizontalAlignment = 'center';
app.MS3_z.Position = [167 60 48 22];
app.MS3_z.Value = 1000;
% Create MS1mLabel
app.MS1mLabel = uilabel(app.Panel_4);
app.MS1mLabel.FontWeight = 'bold';
app.MS1mLabel.Position = [16 189 128 22];
app.MS1mLabel.Text = '导弹 1 初始坐标 MS1(m)';
% Create MS2mLabel
app.MS2mLabel = uilabel(app.Panel_4);
app.MS2mLabel.FontWeight = 'bold';
app.MS2mLabel.Position = [16 131 128 22];
app.MS2mLabel.Text = '导弹 2 初始坐标 MS2(m)';
% Create MS3mLabel
app.MS3mLabel = uilabel(app.Panel_4);
app.MS3mLabel.FontWeight = 'bold';
app.MS3mLabel.Position = [16 85 128 22];
app.MS3mLabel.Text = '导弹 3 初始坐标 MS3(m)';
% Create v_2
app.v_2 = uieditfield(app.Panel_4, 'numeric');
app.v_2.ValueDisplayFormat = '%.2f';
app.v_2.ValueChangedFcn = createCallbackFcn(app, @v_2ValueChanged, true);
app.v_2.HorizontalAlignment = 'center';
app.v_2.Position = [302 60 48 22];
app.v_2.Value = 250;
% Create VmsLabel_2
app.VmsLabel_2 = uilabel(app.Panel_4);
app.VmsLabel_2.FontWeight = 'bold';
app.VmsLabel_2.Position = [236 60 66 22];
app.VmsLabel_2.Text = '速度 V(m/s)';
% Create dtsLabel_2
app.dtsLabel_2 = uilabel(app.Panel_4);
app.dtsLabel_2.FontWeight = 'bold';
app.dtsLabel_2.Position = [198 20 103 22];
app.dtsLabel_2.Text = '模拟时间间隔 dt(s)';
% Create dt_2
```

```
app.dt_2 = uieditfield(app.Panel_4, 'numeric');
app.dt_2.ValueDisplayFormat = '%.2f';
app.dt_2.HorizontalAlignment = 'center';
app.dt_2.Position = [303 20 48 22];
app.dt_2.Value = 0.05;
% Create Label_33
app.Label_33 = uilabel(app.Panel_4);
app.Label_33.FontWeight = 'bold';
app.Label_33.Position = [407 106 65 22];
app.Label_33.Text = '图片刷新率';
% Create Knob_3
app.Knob_3 = uiknob(app.Panel_4, 'continuous');
app.Knob_3.Limits = [0 343];
app.Knob_3.ValueChangingFcn = createCallbackFcn(app, @Knob_3ValueChanging, true);
app.Knob_3.Position = [261 112 60 60];
app.Knob_3.Value = 250;
% Create Knob_4
app.Knob_4 = uiknob(app.Panel_4, 'discrete');
app.Knob_4.Items = {'Fast', 'Quick', 'Medium', 'Slow'};
app.Knob_4.Position = [406 130 60 60];
app.Knob_4.Value = 'Fast';
% Create Label_34
app.Label_34 = uilabel(app.Panel_4);
app.Label_34.Position = [16 60 16 22];
app.Label_34.Text = '（';
% Create Label_35
app.Label_35 = uilabel(app.Panel_4);
app.Label_35.Position = [217 60 10 22];
app.Label_35.Text = '）';
% Create Label_36
app.Label_36 = uilabel(app.Panel_4);
app.Label_36.FontWeight = 'bold';
app.Label_36.Position = [87 60 10 22];
app.Label_36.Text = ', ';
% Create Label_37
app.Label_37 = uilabel(app.Panel_4);
app.Label_37.FontWeight = 'bold';
app.Label_37.Position = [160 60 10 22];
app.Label_37.Text = ', ';
% Create Label_38
app.Label_38 = uilabel(app.Panel_4);
app.Label_38.FontWeight = 'bold';
app.Label_38.Position = [86 107 10 22];
app.Label_38.Text = ', ';
% Create Label_39
app.Label_39 = uilabel(app.Panel_4);
app.Label_39.FontWeight = 'bold';
app.Label_39.Position = [160 107 10 22];
app.Label_39.Text = ', ';
% Create Label_40
app.Label_40 = uilabel(app.Panel_4);
```

```
app.Label_40.Position = [16 107 16 22];
app.Label_40.Text = '（';
% Create Label_41
app.Label_41 = uilabel(app.Panel_4);
app.Label_41.Position = [217 107 10 22];
app.Label_41.Text = '）';
% Create Label_42
app.Label_42 = uilabel(app.Panel_4);
app.Label_42.Position = [16 160 16 22];
app.Label_42.Text = '（';
% Create Label_43
app.Label_43 = uilabel(app.Panel_4);
app.Label_43.FontWeight = 'bold';
app.Label_43.Position = [87 160 10 22];
app.Label_43.Text = ', ';
% Create Label_44
app.Label_44 = uilabel(app.Panel_4);
app.Label_44.FontWeight = 'bold';
app.Label_44.Position = [160 160 10 22];
app.Label_44.Text = ', ';
% Create Label_45
app.Label_45 = uilabel(app.Panel_4);
app.Label_45.Position = [217 160 10 22];
app.Label_45.Text = '）';
% Create TsLabel_2
app.TsLabel_2 = uilabel(app.Panel_4);
app.TsLabel_2.FontWeight = 'bold';
app.TsLabel_2.Position = [17 20 99 22];
app.TsLabel_2.Text = '最长捕获时间 T(s)';
% Create T_2
app.T_2 = uieditfield(app.Panel_4, 'numeric');
app.T_2.ValueDisplayFormat = '%.2f';
app.T_2.HorizontalAlignment = 'center';
app.T_2.Position = [116 20 48 22];
app.T_2.Value = 50;
% Create Panel_7
app.Panel_7 = uipanel(app.Panel_4);
app.Panel_7.Position = [379 10 148 87];
% Create Button_2
app.Button_2 = uibutton(app.Panel_7, 'push');
app.Button_2.ButtonPushedFcn = createCallbackFcn(app, @Button_2Pushed, true);
app.Button_2.BackgroundColor = [0.0745 0.6235 1];
app.Button_2.FontWeight = 'bold';
app.Button_2.FontColor = [1 1 1];
app.Button_2.Position = [5 59 137 24];
app.Button_2.Text = '开始模拟多弹协同追踪';
% Create Button_6
app.Button_6 = uibutton(app.Panel_7, 'push');
app.Button_6.ButtonPushedFcn = createCallbackFcn(app, @Button_6Pushed, true);
app.Button_6.BackgroundColor = [0.0745 0.6235 1];
app.Button_6.FontWeight = 'bold';
```

```
app.Button_6.FontColor = [1 1 1];
app.Button_6.Position = [5 32 138 24];
app.Button_6.Text = '保存本次模拟数据';
% Create Button_7
app.Button_7 = uibutton(app.Panel_7, 'push');
app.Button_7.ButtonPushedFcn = createCallbackFcn(app, @Button_7Pushed, true);
app.Button_7.BackgroundColor = [0.0745 0.6235 1];
app.Button_7.FontWeight = 'bold';
app.Button_7.FontColor = [1 1 1];
app.Button_7.Position = [5 5 65 24];
app.Button_7.Text = '复位';
% Create Button_8
app.Button_8 = uibutton(app.Panel_7, 'push');
app.Button_8.ButtonPushedFcn = createCallbackFcn(app, @Button_8Pushed, true);
app.Button_8.BackgroundColor = [0.0745 0.6235 1];
app.Button_8.FontWeight = 'bold';
app.Button_8.FontColor = [1 1 1];
app.Button_8.Position = [74 5 70 24];
app.Button_8.Text = '退出';
% Create Label_46
app.Label_46 = uilabel(app.Tab_3);
app.Label_46.HorizontalAlignment = 'right';
app.Label_46.FontWeight = 'bold';
app.Label_46.FontColor = [0.149 0.149 0.149];
app.Label_46.Position = [580 20 53 22];
app.Label_46.Text = '模拟状态';
% Create moni_zhuangtai_2
app.moni_zhuangtai_2 = uitextarea(app.Tab_3);
app.moni_zhuangtai_2.Editable = 'off';
app.moni_zhuangtai_2.FontWeight = 'bold';
app.moni_zhuangtai_2.FontColor = [0 0.4471 0.7412];
app.moni_zhuangtai_2.Position = [643 20 220 23];
app.moni_zhuangtai_2.Value = {'请耐心等待模拟推演完毕！'};
% Create Lamp_2Label
app.Lamp_2Label = uilabel(app.Tab_3);
app.Lamp_2Label.HorizontalAlignment = 'right';
app.Lamp_2Label.FontWeight = 'bold';
app.Lamp_2Label.Position = [905 21 77 22];
app.Lamp_2Label.Text = '导弹状态指示';
% Create Lamp_2
app.Lamp_2 = uilamp(app.Tab_3);
app.Lamp_2.Position = [997 22 20 20];
app.Lamp_2.Color = [0 0 0];
% Create Tab_5
app.Tab_5 = uitab(app.TabGroup2);
app.Tab_5.Title = '使用手册 2';
% Create Label_47
app.Label_47 = uilabel(app.Tab_5);
app.Label_47.BackgroundColor = [0.0745 0.6235 1];
app.Label_47.FontSize = 15;
app.Label_47.FontWeight = 'bold';
```

```
            app.Label_47.FontColor = [1 1 1];
            app.Label_47.Position = [18 460 1046 25];
            app.Label_47.Text = '多弹协同追踪模拟使用说明';
            % Create TextArea_2
            app.TextArea_2 = uitextarea(app.Tab_5);
            app.TextArea_2.Editable = 'off';
            app.TextArea_2.FontSize = 17;
            app.TextArea_2.Position = [18 3 1046 458];
            app.TextArea_2.Value = {'说明详情：本段文字围绕“基于 chan 算法和最小二乘优化的多弹协同追踪模型仿真计算器”，介绍其使用说明，旨在阐明其使用方法，指明如何使用该软件进行一次多弹协同无源定位追踪仿真模拟实验。'; ''; '一、在初次打开软件时，在“多弹协同”栏下，在“超参数设置”面板中，预设了一次 demo 超参数值，可无需改动超参数值，点击蓝色按钮“开始模拟多弹协同追踪”，即可进行一次模拟。'; ''; '二、超参数设置面板说明'; '在左上方的超参数设置面板中，共计 12 个超参数可供调整，下面依次说明其含义。'; '（1）导弹 1 初始坐标 MS1（m）：填写三个双精度浮点值分别对应在模拟中编号为 1 的导弹的 x、y、z 坐标值。'; '（2）导弹 2 初始坐标 MS2（m）：填写三个双精度浮点值分别对应在模拟中编号为 2 的导弹的 x、y、z 坐标值。'; '（3）导弹 3 初始坐标 MS3（m）：填写三个双精度浮点值分别对应在模拟中编号为 3 的导弹的 x、y、z 坐标值。'; '（4）期待捕获时间 T（s）：指某次模拟中，导弹被设置的最大追踪时间，超过此时间阈值表示，未能在预计时间追踪到目标，此时，可适当增大其值，以实现在预期时间内成功捕获目标。'; '（5）模拟时间间隔 dt（s）：指模拟中设置的时间步长，建议不调整该参数值，若要调整，取值范围为[0.1,1]（s）。'; '（6）速度 v（m/s）：指模拟中导弹的最大速度值，标量，取值范围为[0,343]（m/s），建议选取大于 150 的值，以便导弹顺利击打目标可转动旋钮取值，也可在编辑框中输入数值调整其值。'; '（7）图片刷新率：指在某次模拟完成后，展示模拟过程时在左侧的图框中展示图片的速率。'; '（8）开始模拟多弹协同追踪：点击即可以上述的超参量数值进行一次模拟实验，并观察结果，模拟状态信息说明见三。'; '（9）保存本次模拟数据：点击即可保存本次模拟的数据文件，包括完整的过程图像以及包含导弹和目标的状态信息的 excel 文件。'; '（10）复位：将擦除本次模拟图像，并修改超参数设置面板中的可调参数为初始的 demo 值（图像刷新速率不会被复位）。'; '（11）退出：退出软件。'; ''; '三、模拟状态信息面板说明'; '在左下方的模拟状态信息面板中，共计 22 个模拟状态信息值用于显示，下面依次说明其含义。'; '（1）仰角 ϕ1、ϕ2、ϕ3（rad）：其值是指目标在某一时刻分别相对于导弹 1、导弹 2、导弹 3 的仰角，为弧度制。'; '（2）方位角 θ1、θ2、θ3（rad）：其值是指目标在某一时刻分别相对于导弹 1、导弹 2、导弹 3 的方位角，为弧度制。'; '（3）导弹实时速度（m/s）：其值是指导弹在某一时刻的瞬时速度。'; '（4）最优距离（m）：其值是指在某一时刻，3 枚导弹和目标之间的绝对距离的最小值。'; '（5）导弹 1/2/3 实时坐标、目标实时坐标（m）：分别表示导弹 1/2/3 和目标的实时位置坐标。'; '（6）模拟耗时（s）：其值表示自模拟开始进行直至模拟推演完毕并完成绘图所经历的时间。'; '（7）模拟结果：显示模拟的结果信息，值可能是“成功在先定时间内击中目标”或者“未能击中目标”。'; ''; '四、右下角模拟状态说明'; '（1）模拟状态中的文本显示当前模拟的进度。'; '（2）导弹状态为“绿色”，表示导弹与目标的距离超过 500m，为“蓝色”表示导弹与目标的距离在 100m 和 500m 之间，为“红色”，表示目标被击毁，距离在导弹引爆范围内。'; ''; '五、右上角图框说明'; '（1）图中展示的是单弹追踪某次模拟的动态过程，可以点击另存为保存模拟图片，可以长按左键并移动转移视角，滑动滚轮缩放视图。'; '（2）标签可以拖动以便观察完整的模拟过程。'};
            % Create chanButton
            app.chanButton = uibutton(app.UIFigure, 'push');
            app.chanButton.IconAlignment = 'center';
            app.chanButton.BackgroundColor = [0.4314 0.749 0.9608];
            app.chanButton.FontSize = 23;
            app.chanButton.FontWeight = 'bold';
            app.chanButton.FontColor = [1 1 1];
            app.chanButton.Position = [5 499 1158 49];
            app.chanButton.Text = '基于无源定位的目标追踪仿真软件';
            % Show the figure after all components are created
            app.UIFigure.Visible = 'on';
        end
    end
    % App creation and deletion
```

```
    methods (Access = public)
        % Construct app
        function app = PassiveLocation
            % Create UIFigure and components
            createComponents(app)
            % Register the app with App Designer
            registerApp(app, app.UIFigure)
            if nargout == 0
                clear app
            end
        end
        % Code that executes before app deletion
        function delete(app)
            % Delete UIFigure when app is deleted
            delete(app.UIFigure)
        end
    end
end
%辅助页面（保存模拟数据弹窗）
classdef AuxApp < matlab.apps.AppBase
    % Properties that correspond to app components
    properties (Access = public)
        UIFigure  matlab.ui.Figure
        tab_name  matlab.ui.control.EditField
        Label_3   matlab.ui.control.Label
        Button_3  matlab.ui.control.Button
        Button_2  matlab.ui.control.Button
        name      matlab.ui.control.EditField
        Label_2   matlab.ui.control.Label
        Button    matlab.ui.control.Button
        type      matlab.ui.control.DropDown
        Label     matlab.ui.control.Label
    end
    properties (Access = private)
        CallingApp % Description
    end
    % Callbacks that handle component events
    methods (Access = private)
        % Code that executes after component creation
        function startupFcn(app, mainapp, fig_name, fig_type)
            app.CallingApp = mainapp;
        end
        % Button pushed function: Button_3
        function Button_3Pushed(app, event)
            delete(app);
        end
        % Button pushed function: Button_2
        function Button_2Pushed(app, event)
            app.name.Value
            updateData(app.CallingApp,app.name.Value,app.type.Value,app.tab_name.Value);
            delete(app);
```

```
        end
        % Value changed function: name
        function nameValueChanged(app, event)
            value = app.name.Value;
%           app.name.Value = value;
        end
        % Value changed function: type
        function typeValueChanged(app, event)
            value = app.type.Value;
%           app.type.Value = value;
        end
    end
    % Component initialization
    methods (Access = private)
        % Create UIFigure and components
        function createComponents(app)
            % Create UIFigure and hide until all components are created
            app.UIFigure = uifigure('Visible', 'off');
            app.UIFigure.Position = [100 100 220 184];
            app.UIFigure.Name = 'MATLAB App';
            % Create Label
            app.Label = uilabel(app.UIFigure);
            app.Label.HorizontalAlignment = 'right';
            app.Label.Position = [12 83 65 22];
            app.Label.Text = '图片格式：';
            % Create type
            app.type = uidropdown(app.UIFigure);
            app.type.Items = {'tif', 'tiff', 'pdf', 'png', 'jpg', 'jpeg'};
            app.type.ValueChangedFcn = createCallbackFcn(app, @typeValueChanged, true);
            app.type.Position = [83 83 130 22];
            app.type.Value = 'tif';
            % Create Button
            app.Button = uibutton(app.UIFigure, 'push');
            app.Button.BackgroundColor = [0.0745 0.6235 1];
            app.Button.FontWeight = 'bold';
            app.Button.FontColor = [1 1 1];
            app.Button.Position = [1 163 220 22];
            app.Button.Text = '保存模拟数据';
            % Create Label_2
            app.Label_2 = uilabel(app.UIFigure);
            app.Label_2.HorizontalAlignment = 'right';
            app.Label_2.Position = [12 123 65 22];
            app.Label_2.Text = '图片名称：';
            % Create name
            app.name = uieditfield(app.UIFigure, 'text');
            app.name.ValueChangedFcn = createCallbackFcn(app, @nameValueChanged, true);
            app.name.Position = [85 123 128 22];
            % Create Button_2
            app.Button_2 = uibutton(app.UIFigure, 'push');
            app.Button_2.ButtonPushedFcn = createCallbackFcn(app, @Button_2Pushed, true);
            app.Button_2.BackgroundColor = [0.902 0.902 0.902];
```

```
            app.Button_2.Position = [121 7 92 22];
            app.Button_2.Text = '保存';
            % Create Button_3
            app.Button_3 = uibutton(app.UIFigure, 'push');
            app.Button_3.ButtonPushedFcn = createCallbackFcn(app, @Button_3Pushed, true);
            app.Button_3.BackgroundColor = [0.902 0.902 0.902];
            app.Button_3.Position = [17 7 92 22];
            app.Button_3.Text = '取消';
            % Create Label_3
            app.Label_3 = uilabel(app.UIFigure);
            app.Label_3.HorizontalAlignment = 'right';
            app.Label_3.Position = [17 45 101 22];
            app.Label_3.Text = '输出 excel 文件名：';
            % Create tab_name
            app.tab_name = uieditfield(app.UIFigure, 'text');
            app.tab_name.Position = [118 45 95 22];
            % Show the figure after all components are created
            app.UIFigure.Visible = 'on';
        end
    end
    % App creation and deletion
    methods (Access = public)
        % Construct app
        function app = AuxApp(varargin)
            % Create UIFigure and components
            createComponents(app)
            % Register the app with App Designer
            registerApp(app, app.UIFigure)
            % Execute the startup function
            runStartupFcn(app, @(app)startupFcn(app, varargin{:}))
            if nargout == 0
                clear app
            end
        end
%
        % Code that executes before app deletion
        function delete(app)
            % Delete UIFigure when app is deleted
            delete(app.UIFigure)
        end
    end
end
```