```
clear,clc;  % Clear irrelevant variables
e=1.6*10^-19;
ep=11.1*8.85*10^-12;
R0=10^4;
C0=0.33*10^-6; % Input constant;
S=10^-8;
N0=10^24;
Vbi=1.8;
  % Take light chip area 0.01mm^2;
  % Take positive conduction voltage as Vbi;
v0=[8.936,16.748,22.705,41.3086,...
    55.957,88.3789,149.553,205.487,...
    234.863,255.371,284.668,289.551,...
    298.34,298.34,306.152,315.918,...
    340.332]*10^(-3)*(-1);
I0=v0/R0;
  % Input experimental signals as initial criteria;
dt=5*10^-9;
T=8*10^-7;
tspan=0:dt:T;
  % Set calculation time span;
function [y] = f(Vre,V,dV,C_led)
  R0=10^4;
  C0=0.33*10^-6;
  y=(Vre-V-R0*(2*C_led+C0)*dV)/(R0^2*C0*C_led);
end
  % Set Secondary differential calculation function;
function [z]=C_led(V)
  S=10^-8;
  N0=6*10^24;
  Vbi=1.8;
  e=1.6*10^-19;
  ep=11.1*8.85*10^-12;
  z=S*sqrt(ep*e*N0/2)*sqrt(1/(Vbi-V));
  % Set LED capacity calculation function;
end
Vre=[-25.4:-0.05:-25.95,-26:-0.1:-26.4];
tau=zeros(1,length(I0));
  % Record circuit quench time tau;
figure
hold on
for ii=1:length(Vre)
  % Change Vre and calculate V_LED;
V=zeros(1,length(tspan));
V(1)=-25.4;
dV=zeros(1,length(tspan));
dV(1)=I0(ii)/C_led(V(1));
I=zeros(1,length(tspan));
I(1)=I0(ii);
```

```
C1=zeros(1,length(tspan));
  % Set stacking arrays
  % Use empirical initial criteria;
k=0;
% Solving the differential equation with Runge-Kutta method:
for n=1:length(tspan)-1
    dV1=dV(n);
    d2V1=f(Vre(ii),V(n),dV1,C_led(V(n)));
    dV2=dV1+d2V1*dt/2;
    d2V2=f(Vre(ii),V(n)+dV1*dt/2,dV1+d2V1*dt/2,...
        C_led(V(n)+dV1*dt/2));
    dV3=dV1+d2V2*dt/2;
    d2V3=f(Vre(ii),V(n)+dV2*dt/2,dV2+d2V2*dt/2,...
        C_led(V(n)+dV2*dt/2));
    dV4=dV1+d2V3*dt/2;
    d2V4=f(Vre(ii),V(n)+dV3*dt/2,dV3+d2V3*dt/2,...
        C_led(V(n)+dV3*dt/2));
    V(n+1)=V(n)+dt/6*(dV1+2*dV2+2*dV3+dV4);
    dV(n+1)=dV(n)+dt/6*(d2V1+2*d2V2+2*d2V3+d2V4);
    I(n+1)=dV(n+1)*C_led(V(n+1));
  % Find Quench time tau;
    if (abs(I(n+1))<10^(-6))
        if (k==0)
            tau(ii)=tspan(n+1);
            k=1;
        end
    end
end
plot(tspan,I);
end
legend('Vre=-25.4V','Vre=-25.45V','Vre=-25.5V',...
    'Vre=-25.55V','Vre=25.6V','Vre=25.65V','Vre=25.7V',...
    'Vre=25.75V','Vre=25.8V','Vre=25.85V','Vre=25.9V',...
    'Vre=26V','Vre=26.1V','Vre=26.2V','Vre=26.3V',...
    'Vre=26.4V')
xlabel('t/s')
ylabel('I_led/mA')
title('Calculation of Quenching Current of Reverse-biased LED ')
hold off
  % Plot and annotate the calculation results
Tau=[0.0528,1.464,1.919,2.26,2.64,...
    2.95,3.35,3.24,3.944,4.3536,4.175,...
    4.324,4.3424,5.156,4.6,5.336,5.451];
figure
plot(Vre,tau*10^7,'b-',Vre,Tau,'ro')
xlabel('Vre/V')
ylabel('Quench time/μs')
legend('Theoretical','Experiment')
title('Quench time - Reverse bias Voltage Plot')
```

```
% Compare theoretical calculations and experimental results on plot;
```