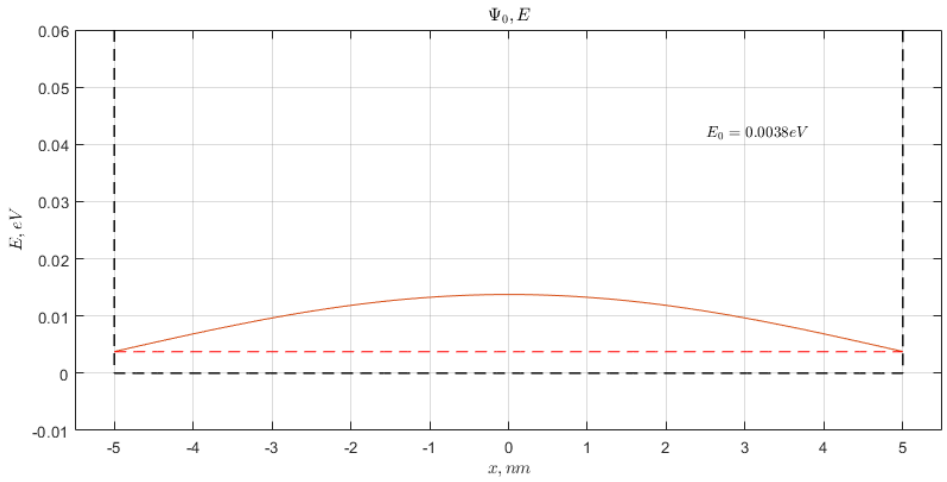
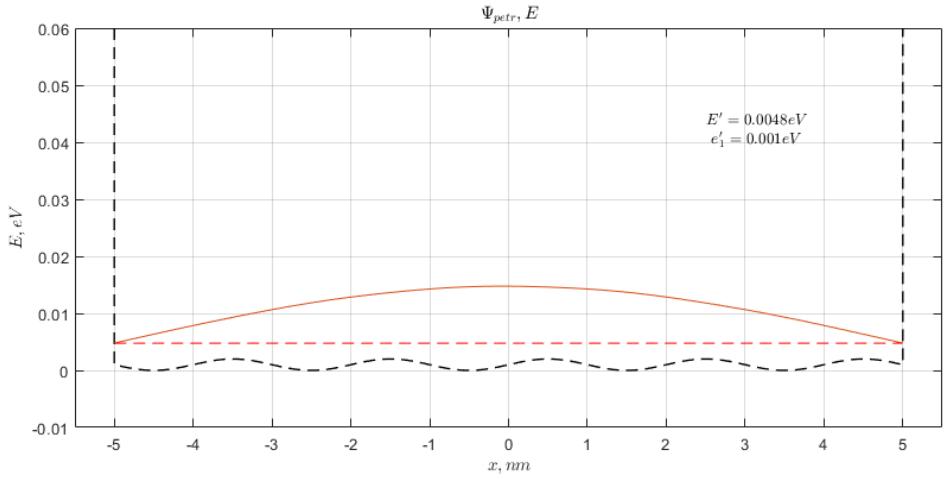
```
%preaparing workspace
clear
close all
clc

%defining constants
hbar=1.0546e-34;
m0=9.1e-31;
e=1.6e-19;
k=1.38e-23;

%forming a task
L=1e-8;
Np=1000;
dx=L/Np;
x=linspace(-L/2,L/2, Np);
% Psi=@(n) sqrt(2/L)*sin((pi*n.*x)/L);
koef=-hbar^2/(2*m0*12*(dx^2));

%H=U+Ep
U=zeros(1,Np);
Upetr=0.001*e*(1+sin(pi*10*x/L));

E=eye(Np)*(-30);
for i=1:Np-1
    E(i,i+1)=E(i,i+1)+16;
    E(i+1,i)=E(i+1,i)+16;
end
for i=1:Np-2
    E(i,i+2)=E(i,i+2)-1;
    E(i+2,i)=E(i+2,i)-1;
end

%Hamiltonian
H=E*koef+diag(U);
Hpetr=E*koef+diag(U+Upetr);

%finding eigenvalues and eigenvectors
[P,En]=eig(H);
[Ppetr,Enpetr]=eig(Hpetr);
En=diag(En);
Enpetr=diag(Enpetr);

%Finding an amendment to Energy
n=P(:,1);
dE=n'*diag(Upetr)*n/e;

%visualization
F=figure('Units', 'normalized', 'OuterPosition', [0.25 0 0.5 1]);
subplot(2,1,1)
plot([-L/2 x L/2]*1e9, [0.06 U/e 0.06], '--k', 'LineWidth', 1)
hold on;
```

```
for i=1:1
    plot(x*1e9, En(i)/e+0.01*P(:,i)/P(islocalmax(P(:,i)),1));
    plot(x*1e9, En(i)*ones(1,Np)/e,'--r');
end
E1=En(1)/e;
xlabel('$x,nm$', 'Interpreter', 'latex');
ylabel('$E,eV$', 'Interpreter', 'latex');
title('$\Psi_0,E$', 'Interpreter', 'latex');
text((sum(xlim) + diff(xlim))/2-0.5*(diff(xlim)-
sum(xlim))/2,0.7*sum(ylim),sprintf('$E_0 = %2.2g eV
$',E1),'Interpreter','latex')
grid on;
ylim([-0.01 0.06])
xlim([-L/2*1.1 L/2*1.1]*1e9)

subplot(2,1,2)
plot([-L/2 x L/2]*1e9, [0.06 Upetr/e 0.06], '--k', 'LineWidth', 1)
hold on;
for i=1:1
    plot(x*1e9, Enpetr(i)/e+0.01*Ppetr(:,i)/
Ppetr(islocalmax(Ppetr(:,i)),1));
    plot(x*1e9, Enpetr(i)*ones(1,Np)/e,'--r');
end
E2=Enpetr(1)/e;
xlabel('$x,nm$', 'Interpreter', 'latex');
ylabel('$E,eV$', 'Interpreter', 'latex');
title('$\Psi_{petr},E$', 'Interpreter', 'latex');
text((sum(xlim) + diff(xlim))/2-0.5*(diff(xlim)-
sum(xlim))/2,0.7*sum(ylim),sprintf("$E' = %2.2g eV$ \n $e_1' = %2.2g
 eV$",[E2,dE]),'Interpreter','latex')
grid on;
ylim([-0.01 0.06])
xlim([-L/2*1.1 L/2*1.1]*1e9)
```





Published with MATLAB® R2020b