```
%preparing workspace
clc
clear
close all

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

%initial paramets
a=3e-9;                 %size of chanel, 3nm
b=2e-9;                 %size of barrier, 2nm
U0=1*e;                 %height of barrier, 1 eV
m=0.067*m0;             %eff. mass in GaAs, kg
mb=(0.067+0.083*0.5)*m0;%eff. mass in AlGaAs(0.5), kg
Ef=0.14*e;              %Fermi energy, (at T=300)
T=300;                  %room temperature, K
v=1e6;                  %frequency, 1Mhz
Ez=3.16*e;              %connection energy
V=@(t)sin(2*pi*v*t);    %periodic voltage, V
Nsteps=100;             %amount of steps
t=linspace(0,5,Nsteps)*1e-6;  %time, 0-2 mcs

% plot(t,exp(-e*V(t)/(k*T)))

% V=V(0.359e-6);

% syms Nw(t) V(t) hbar m b e Ef Ez v k T eps
% syms Nw(t) V(t)
% V=sin(2*pi*v*t);

eps=0.814*e;

Eks=@(nw,t)eps;
Ekd=@(nw,t)eps+e*V(t);
Ekw=@(nw,t)eps+e*V(t)/2-Ez*nw;

wsw=@(nw,t)sqrt(2*Eks(nw,t)/m)/b;
wdw=@(nw,t)sqrt(2*Ekd(nw,t)/m)/b;
wws=@(nw,t)sqrt(2*Ekw(nw,t)/m)/b;
wwd=@(nw,t)wws(nw,t);

f2d=@(E) m*2*k*T/hbar^2*log(1+exp((Ef-E)/(k*T)));

Efs=Ef;
Efd=@(t)Ef-e*V(t);

ns=f2d(Efs);
nd=@(t)f2d(Efd(t));
```

```
jsw=@(nw,t)wsw(nw,t)*ns*(1-nw);
jdw=@(nw,t)wdw(nw,t)*nd(t)*(1-nw);
jws=@(nw,t)wws(nw,t)*nw;
jwd=@(nw,t)wwd(nw,t)*nw;

dNdt=@(nw,t)jsw(nw,t)+jdw(nw,t)-jws(nw,t)-jwd(nw,t);

    %now we suppose dnw/dt is /\nw//\t and Nw(0)=0, so Nw(i)=Nw(i-1)+/
\N
dt=t(2)-t(1);
N=zeros(1,100);
J=N;
for i=2:Nsteps
    temp=dNdt(N(i-1),t(i-1));
    N(i)=N(i-1)+temp*dt;
    J(i)=jsw(N(i),t(i))-jdw(N(i),t(i))-jws(N(i),t(i))+jwd(N(i),t(i));
end



% plot(J,V(t))
% eq = diff(Nw,t)== jsw(Nw)+jdw(Nw)-jws(Nw)-jws(Nw);
% pretty(eq)
% N=solve(eq)

% figure ('Units','normalized','OuterPosition', [0 0 1 1])
% subplot(2,2,1)
% plot(t,V(t));
```

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