applied sciences

MDPI

Article

The Calculation of Maximum Electric Field Intensity in Brain Tissue Stimulated by a Current Pulse Through a Microcoil Via Capacitive Coupling

Mohammed Alzahrani and Bradley J. Roth *

Dept, Physics, Oakland University, Rochester, Michigan, 48309, USA; alzahrani@oakland.edu

* Correspondence: roth@oakland.edu; Tel.: (248) 375-2703

Supplementary Material File S1

The MATLAB program used to perform the calculations is given below.

```
Nt=1000000;
Nx=21;
L=0.001;
U=zeros(Nt,Nx);
V=zeros(Nt,Nx);
Vi=zeros(Nt,Nx);
Ve=zeros(Nt,Nx);
deltat=0.000000001;
deltax=2*L/(Nx-1);
t(1)=0;
W=2*pi*3000;
ri=850;
re=3.2e8;
k=3.8;
eo=8.85e-12;
d=0.3e-6;
a=2.5e-6;
C=k*eo/d;
D=1/(2*pi*a*C*(ri+re));
I=0.001;
c1=deltax*ri*I;
c2=deltat/deltax^2*D;
c3=ri*I;
for j=1:Nx
x(j)=-L+(j-1)*deltax;
V(1,j)=0;
U(1,j)=0;
end
ncount=0;
```

```
Ebig=0;
for i=2:Nt;
t(i)=t(i-1)+deltat;
for j=2:Nx-1;
V(i,j)=V(i-1,j)+c2*(V(i-1,j+1)+V(i-1,j-1)-2*V(i-1,j));
end
V(i,1)=V(i,2)+c1*sin(W*t(i));
V(i,Nx)=V(i,Nx-1)-c1*sin(W*t(i));
for j=1:Nx
U(i,j)=-c3*sin(W*t(i))*x(j);
end
for j=1:Nx
Ve(i,j)=(re/(ri+re))*(U(i,j)-V(i,j));
Vi(i,j)=(re/(ri+re))*(U(i,j)+(ri/re)*V(i,j));
end
for j=2:Nx-1
E(i,j)=-(Ve(i,j+1)-Ve(i,j-1))/(2*deltax);
end
if(E(i,(Nx+1)/2)>Ebig)
Ebig=E(i,(Nx+1)/2);
end
ncount=ncount+1;
if(ncount>99999)
i
ncount=0;
end
end
Ebig
```