José Luis Madrigal

MATLAB Electromagnetism simulations

Main file

Tierra3D.m

```
clear; clc; clf; close all;
n = 7;
% Paulo Ogando, Erika Marlene Garcia, Jose Luis Madrigal
% Maximiliano Carrasco, Alan Said Martinez, Christian Parrish Gutierrez
%Parametrización
syms s px py pz dpx dpy dpz
disp("¿Que quieres graficar?");
opcion = input("1. Linea  2. Anillo  3. Solenoide  4.- Solenoide esferico: ");
if opcion == 1
    [q,m,xinicial,vinicial,dominio,l]=basicas(n);
    I = 1;
    Mew = 4*pi*1;
    Const = (Mew*I)/4*pi;
    smin = -20; smax = 20;
    px(s) = 0;
    py(s) = 0;
    pz(s) = s;
end
if opcion == 2
    [q,m,xinicial,vinicial,dominio,l]=basicas(n);
    delta = .01;
    I = 1;
    Mew = 4*pi*1;
    Const = (Mew*I)/4*pi;
    smin = 0; smax = 2*pi;
    px(s) = cos(s);
    py(s) = sin(s);
    pz(s) = 0;
```

```
[posx,posy,posZ] = malladoT3D(n,dominio);
[Bx, By, Bz] = camposM3D(posx,posy,posZ,Const,px,py,pz,dpx,dpy,dpz,doms);
[BxN, ByN, BzN,Mx] = NormalizarB(Bx,By,Bz,l);
[posiciones] = particulas(q, m, xinicial, vinicial, delta, Const,px,py,pz,dpx,dpy,dpz,doms);
GraficarB(posx,posy,posZ,BxN,ByN,BzN,Mx,px,py,pz,doms,posiciones);
```

Tierra3D.m

```
function [q,m,xinicial,vinicial,dominio,l]=basicas(n)

xmin = -2; xmax = 2;
ymin = -2; ymax = 2;
zmin = -2; zmax = 2;
dominio = [xmin,xmax,ymin,ymax,zmin,zmax];
l = (xmax-xmin)/(2*n);
q = 1;
m = 1;
Xi = 0;
Xj = 0;
Xk = 0;
xinicial = [Xi,Xj,Xk];
Vi = 1;
Vj = 1;
Vk = 1;
vinicial = [Vi,Vj,Vk];

end
```

Planet data

Tierra3D.m

```
if opcion == 4
    xmin = -7000000; xmax = 7000000;
    ymin = -7000000; ymax = 7000000;
    zmin = -7000000; zmax = 7000000;
    dominio = [xmin,xmax,ymin,ymax,zmin,zmax];
    l = (xmax-xmin)/(2*n);
    q = -1.6*10^-19;
    m = 9.11*10^-31;
    Xi = 300000;
    Xj = 149000;
    Xk = 210000;
    xinicial = [Xi,Xj,Xk];
    Vi = 400000;
    Vj = 400000;
    Vk = 400000;
    vinicial = [Vi,Vj,Vk];
    delta = .000000525;
    I = 12*10^5;
    Mew = 4*pi*10^-7;
    Const = (Mew*I)/4*pi;
    smin = -99; smax = 99;
    px(s) = 6371000*(sqrt(1-(0.01*s)^2).*cos(s));
    py(s) = 6371000*(sqrt(1-(0.01*s)^2).*sin(s));
    pz(s) = 6371000*(0.01.*s);
end
```

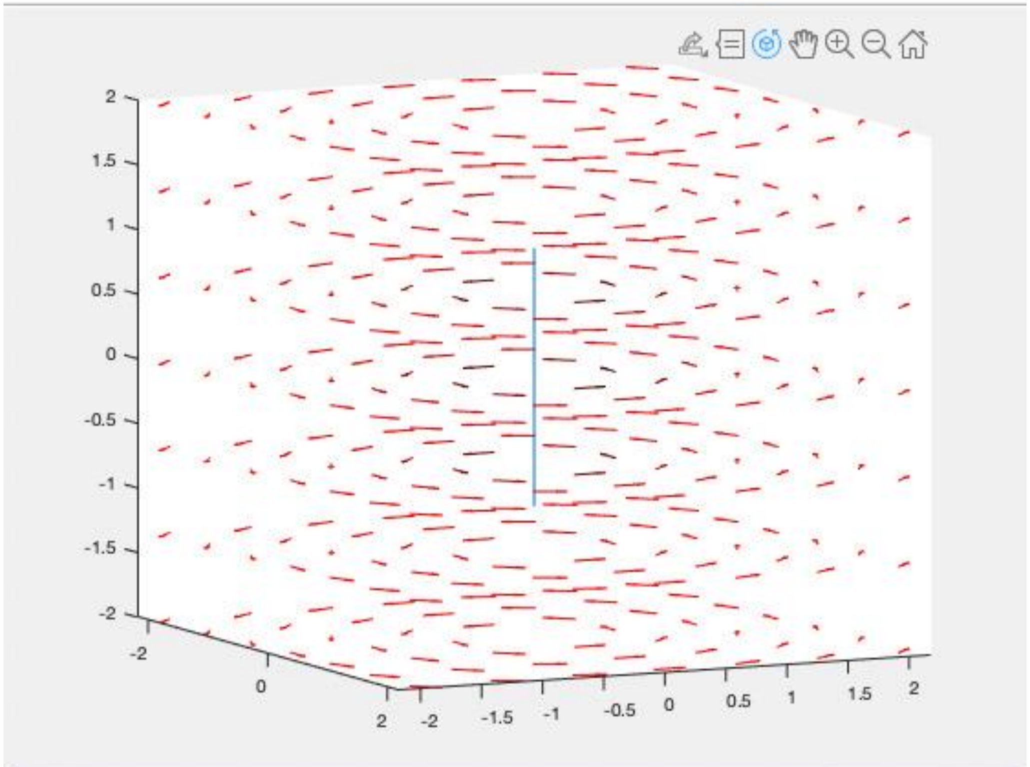
File of one function: Biot Savart

BiotSavart.m

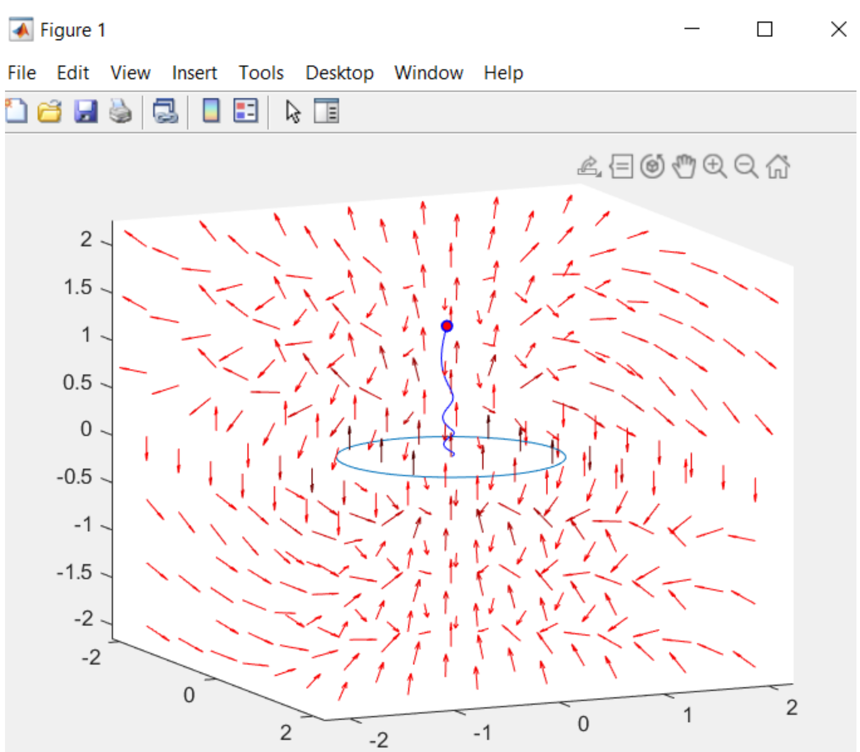
```
function [Bx, By, Bz] = BiotSavart(Const,posx,posy,posZ,px,py,pz,dpx,dpy,dpz,doms)
syms s
%Vector r
rx = posx - px;
ry = posy - py;
rz = posZ - pz;

%Magnitud del vector r
Magr = (rx.^2 + ry.^2 + rz.^2).^(3/2);

%Producto cruz
Cruzi = (dpy*rz - ry*dpz);
Cruzj = -(dpx*rz - rx*dpz);
Cruzk = (dpx*ry - rz*dpy);

%Integrando
dBx(s) = Cruzi / Magr;
dBy(s) = Cruzj / Magr;
dBz(s) = Cruzk / Magr;

%Integracion

Bx = Const * TrapezoideTierra(dBx,20,doms(1),doms(2));
By = Const * TrapezoideTierra(dBy,20,doms(1),doms(2));
Bz = Const * TrapezoideTierra(dBz,20,doms(1),doms(2));
```

José Luis Madrigal

Option 1: Current line (we couldn't get the correct delta to see the trajectory, so this is a screenshot of the first deliverable, just the magnetic field)

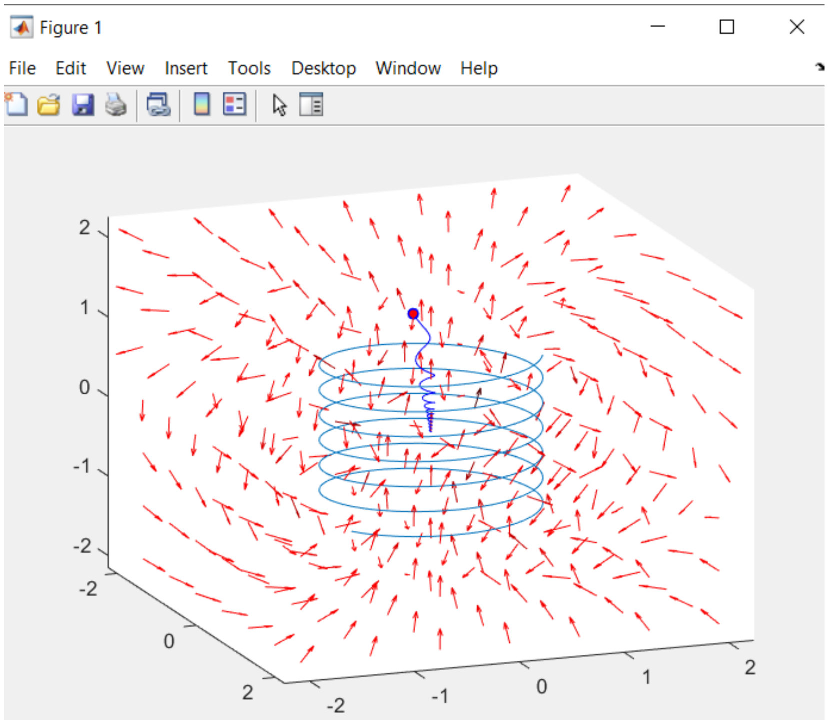


Option 2: Ring (remember this is an animation)

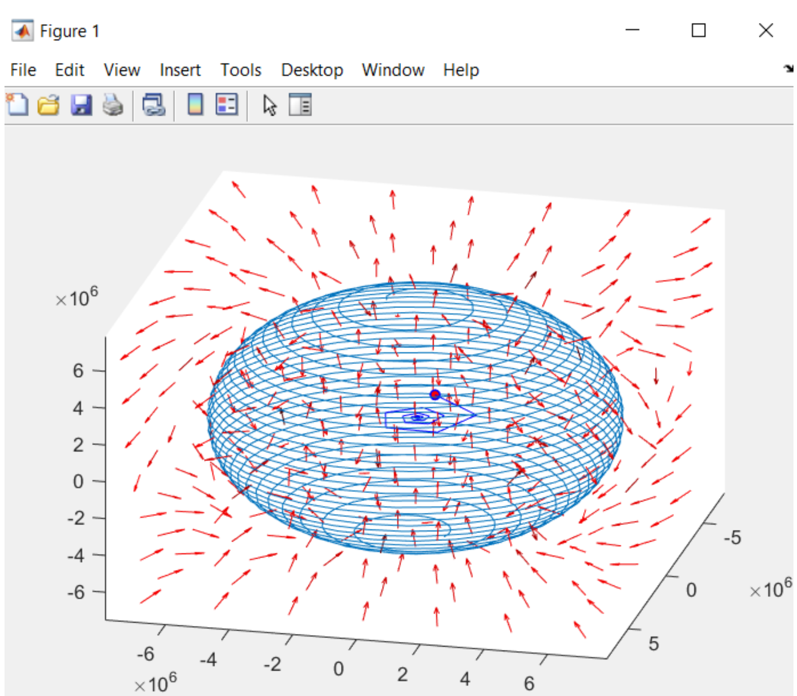


José Luis Madrigal

Option 3: Solenoid



Option 4: Spherical Solenoid (Earth)



Acknowledgments

To my friend who helped me better understand some concepts, Pol (with the Physics laws).