

```

clear all, close all

n=1000; %oszt.sok sz.ma
lambda=4; %hull.mhossz
v=22; %>0 terjedési sebesség (l.tszûlagos, m/s)
dx=1.1; %>1 hull.mhossz megny.l.sa
x1=-2; %<=0 kezdetben a karok bal sz.elsi koordin.t.ja
x2=2; %>=0 kezdetben a karok jobb sz.elsi koordin.t.ja
dfi=pi; %karokban terjedı hull.mok k^z^tti f.zistol.s
ddx=50; %megny.l.s l.ép.essz.ma
n1=50; %elsi halad.si szakasz hossza
n2=150; %m.sodik halad.si szakasz hossza
Ax=1; %amplit.dû az x-karban
Ay=1; %amplit.dû az y-karban

%tengelyfeliratok:
xxL='x (m)'; %x-kar x tengely.ének felirata
yyL='y (m)'; %y-kar x tengely.ének felirata
yL='EMH kit.ér.ése'; %x- és y-kar y tengely.ének felirata
s3yL='detektorjel'; %3. subplot y tengely.ének felirata
s3xL='idı (ns)'; %3. subplot x tengely.ének felirata

k=2*pi/lambda;
lep=(x2-x1)*dx/n;
x0=x1:lep:x2; %GH elıtti kar
x00=x1*dx:lep:x2*dx; %GH ut.ni x kar
x000=x1/dx:lep:x2/dx; %GH ut.ni y kar
v=v/1000; %m/ms
omega=k*v;
kx=k/dx; %megny.lt hull.ms.z.m
ky=k*dx; %lecs.akkent hull.ms.z.m
omegax=kx*v;
omegay=ky*v;
d=(dx-1)/ddx; %megny.l.s l.ép.ese
dt=v*0.001/299792458*1000000000000; %egy l.ép.és val.üdi idıtartama ps-
ban

tx=(x2*dx-x1*dx)/v; %ennyi l.ép.ésben ,r,l ki a hull.m a karokbûl
ty=(x2/dx-x1/dx)/v;

fipi=(x2-x1)*k; %x kar hossz.tûl f.ıggi f.zistol.s a visszeverıd.és
hely.én
if sin(fipi)<=0 && cos(fipi)<=0
    dfix=(3*pi/2-fipi)*2;
elseif sin(fipi)<=0 && cos(fipi)>0
    dfix=-(3*pi/2-fipi)*2;
elseif sin(fipi)>0 && cos(fipi)<=0
    dfix=(pi/2-fipi)*2;
elseif sin(fipi)>0 && cos(fipi)>0
    dfix=-(pi/2-fipi)*2;

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end

fipi=(x2-x1)*k+dfi; %y kar hossz-tól függően a visszeverődés helyén
if sin(fipi)<=0 && cos(fipi)<=0
    dfiy=(3*pi/2-fipi)*2;
elseif sin(fipi)<=0 && cos(fipi)>0
    dfiy=-(3*pi/2-fipi)*2;
elseif sin(fipi)>0 && cos(fipi)<=0
    dfiy=(pi/2-fipi)*2;
elseif sin(fipi)>0 && cos(fipi)>0
    dfiy=-(pi/2-fipi)*2;
end

%kitérés k,l^nségének négyzete
tx=idivide(tx,int32(1),'ceil');
ty=idivide(ty,int32(1),'ceil');
ntlep=n1+n2+2*tx+2; %időlépések száma
It=linspace(0,ntlep*dt,ntlep);
I=zeros(1,length(It)); %detektorjel az időben, elejétől a végéig
for m=1:n1+1
    I(m)=(Ax*sin(x1*k+omega*m+dfix)+Ay*sin(x1*k+omega*m+dfi+dfiy))^2;
end
for m=0:2*tx+n2
    if m<ty
        I(m+n1+2)=(Ax*sin(x1*dx*kx+omegax*m+dfix+omega*n1)+Ay*sin(x1/
dx*ky+omegay*m+dfiy+omega*n1+dfi))^2;
    elseif ty<m && m<tx && m<2*ty
        I(m+n1+2)=(Ax*sin(x1*dx*kx+omegax*m+dfix+omega*n1)+Ay*sin(x1/
dx*ky+omegay*m+dfiy+omega*n1+dfi))^2;
    elseif m>tx && m<2*ty
        I(m+n1+2)=(Ax*sin(x1*dx*kx+omegax*m+dfix+omega*n1)+Ay*sin(x1/
dx*ky+omegay*m+dfiy+omega*n1+dfi))^2;
    elseif m<tx && m>2*ty
        I(m+n1+2)=(Ax*sin(x1*dx*kx+omegax*m+dfix+omega*n1)+Ay*sin(x1/
dx*k+omega*m+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/dx-1))*k+dfi))^2;
    elseif m<2*tx && m>2*ty
        I(m+n1+2)=(Ax*sin(x1*dx*kx+omegax*m+dfix+omega*n1)+Ay*sin(x1/
dx*k+omega*m+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/dx-1))*k+dfi))^2;
    elseif m>2*tx && m>2*ty
        I(m+n1+2)=(Ax*sin(x1*dx*k+omega*m+dfix+omega*n1-(2*x2*(dx-1)-
x1*(dx-1))*k)+Ay*sin(x1/dx*k+omega*m+dfiy+omega*n1+(2*x2*(1-1/dx)
+x1*(1/dx-1))*k+dfi))^2;
    end
end

%gráf:
s1=subplot(3,1,1);
s2=subplot(3,1,2);
s3=subplot(3,1,3);

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im=(Ax+Ay)^2; %s3 y tengelyének felső koordinátája
ia=-(Ax+Ay)^2/8; % s3 y tengelyének alsó koordinátája

%t_k^r (kar szélén a függőleges vonal):
tx1=[x1 x1];
tx2=[x2 x2];
tfx=[-Ax Ax];
tfy=[-Ay Ay];

for j=0:n1 %első haladsi szakasz

    subplot(s1)
    p1=plot(x0,Ax*sin(x0*k-omega*j),'b',x0,Ax*sin(x0*k+omega*j
+dfix),'r',tx1,tfx,'k',tx2,tfx,'k',x1,Ax*sin(x1*k+omega*j+dfix),'r*');
    axis([x1*dx x2*dx -Ax Ax])
    title(['Idő: ' num2str(j*dt,'%5.3f') ' ns'])
    xlabel(xxL)
    ylabel(yL)
    %p1(1).LineWidth=2;

    subplot(s2)
    plot(x0,Ay*sin(x0*k-omega*j+dfi),'b',x0,Ay*sin(x0*k+omega*j+dfi
+dfiy),'r',tx1,tfy,'k',tx2,tfy,'k',x1,Ay*sin(x1*k+omega*j+dfi
+dfiy),'r*')
    axis([x1*dx x2*dx -Ay Ay])
    xlabel(yxL)
    ylabel(yL)

    subplot(s3)
    ploti=zeros([1 j+1]);
    plotit=zeros([1 j+1]);
    for w=1:j+1
        ploti(w)=I(w);
        plotit(w)=It(w);
    end
    plot(plotit,ploti,'k')
    axis([0 ntlep*dt ia im])
    xlabel(s3xL)
    ylabel(s3yL)

    pause(.001)
end

for i=0:ddx %t_gul_s
    xx=x1*(1+d*i):lep:x2*(1+d*i);
    xy=x1/(1+d*i):lep:x2/(1+d*i);

    subplot(s1)
    plot(xx,Ax*sin(xx*k/(1+d*i)-omega*n1),'b',xx,Ax*sin(xx*k/(1+d*i)

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+omega*n1+dfix), 'r', tx1*(1+d*i), tfx, 'k', tx2*(1+d*i), tfx, 'k', x1*(1+d*i)
, Ax*sin(x1*(1+d*i)*k/(1+d*i)+omega*n1+dfix), 'r*')
    axis([x1*dx x2*dx -Ax Ax])
    title(['Id1: ' num2str(n1*dt, '%5.3f') ' ns'])
    xlabel(xxL)
    ylabel(yL)

    subplot(s2)
    plot(xy, Ay*sin(xy*k*(1+d*i)-
omega*n1+dfi), 'b', xy, Ay*sin(xy*k*(1+d*i)+omega*n1+dfi+dfiy), 'r', tx1/
(1+d*i), tfy, 'k', tx2/(1+d*i), tfy, 'k', x1/(1+d*i), Ay*sin(x1/
(1+d*i)*k*(1+d*i)+omega*n1+dfi+dfiy), 'r*')
    axis([x1*dx x2*dx -Ay Ay])
    xlabel(yxL)
    ylabel(yL)

    subplot(s3)
    plot(plotit, ploti, 'r')
    axis([0 ntlep*dt ia im])
    xlabel(s3xL)
    ylabel(s3yL)

    pause(.0001)
end

for l=0:2*tx+n2
    xx1=x1*dx+v*l:lep:x2*dx;
    xx2=x1*dx:lep:x1*dx+v*l;
    vx1=x1*dx:lep:2*x2*dx-x1*dx-v*l;
    vx2=2*x2*dx-x1*dx-v*l:lep:x2*dx;
    xy1=x1/dx+v*l:lep:x2/dx;
    xy2=x1/dx:lep:x1/dx+v*l;
    vy1=x1/dx:lep:2*x2/dx-x1/dx-v*l;
    vy2=2*x2/dx-x1/dx-v*l:lep:x2/dx;

    if l<ty %a kisebb kar vEgEig eljut a t^rEs
        subplot(s1)
        plot(xx1, Ax*sin(xx1*kx-omegax*l-omega*n1), '--
b', xx2, Ax*sin(xx2*k-omegax*l-omega*n1+x1*(1-
dx)*k), 'b', x00, Ax*sin(x00*kx+omegax*l+dfix+omega*n1), '--
r', x1*dx, Ax*sin(x1*dx*kx+omegax*l+dfix+omega*n1), 'r*')
        axis([x1*dx x2*dx -Ax Ax])
        title(['Id1: ' num2str((n1+l)*dt, '%5.3f') ' ns'])
        xlabel(xxL)
        ylabel(yL)

        subplot(s2)
        plot(xy1, Ay*sin(xy1*ky-omegay*l-omega*n1+dfi), '--
b', xy2, Ay*sin(xy2*k-omegax*l-omega*n1-x1*(1/dx-1)*k
+dfi), 'b', x000, Ay*sin(x000*ky+omegay*l+dfiy+omega*n1+dfi), '--r', tx1/

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dx,tfy,'k',tx2/dx,tfy,'k',x1/dx,Ay*sin(x1/dx*ky+omegay*l+dfiy
+omega*n1+dfi),'r*')
    axis([x1*dx x2*dx -Ay Ay])
    xlabel(yxL)
    ylabel(yL)

    subplot(s3)
    ploti=zeros([1 l+n1+2]);
    plotit=zeros([1 l+n1+2]);
    for w=1:l+n1+2
        ploti(w)=I(w);
        plotit(w)=It(w);
    end
    plot(plotit,ploti,'k')
    axis([0 ntlep*dt ia im])
    xlabel(s3xL)
    ylabel(s3yL)

    elseif ty<l && l<tx && l<2*ty %a t^rEs a kisebb karban visszafelE
halad, a nagyobbban mEg oda
        subplot(s1)
        plot(xx1,Ax*sin(xx1*kx-omegax*l-omega*n1),'--
b',xx2,Ax*sin(xx2*k-omega*l-omega*n1+x1*(1-
dx)*k),'b',x00,Ax*sin(x00*kx+omegax*l+dfix+omega*n1),'--
r',x1*dx,sin(x1*dx*kx+omegax*l+dfix+omega*n1),'r*')
        axis([x1*dx x2*dx -Ax Ax])
        title(['Id1: ' num2str((n1+l)*dt,'%5.3f') ' ns'])
        xlabel(xxL)
        ylabel(yL)

        subplot(s2)
        plot(x000,Ay*sin(x000*k-omega*l-omega*n1-x1*(1/dx-1)*k
+dfi),'b',vy1,Ay*sin(vy1*ky+omegay*l+dfiy+omega*n1+dfi),'--
r',vy2,Ay*sin(vy2*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/
dx-1))*k+dfi),'r',tx1/dx,tfy,'k',tx2/dx,tfy,'k',x1/dx,Ay*sin(x1/dx*ky
+omegay*l+dfiy+omega*n1+dfi),'r*')
        axis([x1*dx x2*dx -Ay Ay])
        xlabel(yxL)
        ylabel(yL)

        subplot(s3)
        ploti=zeros([1 l+n1+2]);
        plotit=zeros([1 l+n1+2]);
        for w=1:l+n1+2
            ploti(w)=I(w);
            plotit(w)=It(w);
        end
        plot(plotit,ploti,'k')
        axis([0 ntlep*dt ia im])
        xlabel(s3xL)

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ylabel(s3yL)

elseif l>tx && l<2*ty %y-ban visszafelÈ halad a t^rÈs, x-ben is
    subplot(s1)
        plot(x00,Ax*sin(x00*k-omega*l-omega*n1+x1*(1-
dx)*k), 'b',vx1,Ax*sin(vx1*kx+omegax*l+dfix+omega*n1), '--
r',vx2,Ax*sin(vx2*k+omega*l+dfix+omega*n1-(2*x2*(dx-1)-
x1*(dx-1))*k), 'r',x1*dx,Ax*sin(x1*dx*kx+omegax*l+dfix+omega*n1), 'r*')
        axis([x1*dx x2*dx -Ax Ax])
        title(['Id1: ' num2str((n1+l)*dt, '%5.3f') ' ns'])
        xlabel(xxL)
        ylabel(yL)

        subplot(s2)
        plot(x000,Ay*sin(x000*k-omega*l-omega*n1-x1*(1/dx-1)*k
+dfi), 'b',vy1,Ay*sin(vy1*ky+omegay*l+dfiy+omega*n1+dfi), '--
r',vy2,Ay*sin(vy2*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/
dx-1))*k+dfi), 'r',tx1/dx,tfy, 'k',tx2/dx,tfy, 'k',x1/dx,Ay*sin(x1/dx*ky
+omegay*l+dfiy+omega*n1+dfi), 'r*')
        axis([x1*dx x2*dx -Ay Ay])
        xlabel(yxL)
        ylabel(yL)

        subplot(s3)
        ploti=zeros([1 l+n1+2]);
        plotit=zeros([1 l+n1+2]);
        for w=1:l+n1+2
            ploti(w)=I(w);
            plotit(w)=It(w);
        end
        plot(plotit,ploti,'k')
        axis([0 ntlep*dt ia im])
        xlabel(s3xL)
        ylabel(s3yL)

elseif l<tx && l>2*ty %x-ben jobbra halad a t^rÈs, y-ban m·r nincs
benne
    subplot(s1)
        plot(xx1,Ax*sin(xx1*kx-omegax*l-omega*n1), '--
b',xx2,Ax*sin(xx2*k-omega*l-omega*n1+x1*(1-
dx)*k), 'b',x00,Ax*sin(x00*kx+omegax*l+dfix+omega*n1), '--
r',x1*dx,Ax*sin(x1*dx*kx+omegax*l+dfix+omega*n1), 'r*')
        axis([x1*dx x2*dx -Ax Ax])
        title(['Id1: ' num2str((n1+l)*dt, '%5.3f') ' ns'])
        xlabel(xxL)
        ylabel(yL)

        subplot(s2)
        plot(x000,Ay*sin(x000*k-omega*l-omega*n1-x1*(1/dx-1)*k
+dfi), 'b',x000,Ay*sin(x000*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)

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+x1*(1/dx-1))*k+dfi), 'r', tx1/dx, tfy, 'k', tx2/dx, tfy, 'k', x1/
dx, Ay*sin(x1/dx*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/dx-1))*k
+dfi), 'r*')
    axis([x1*dx x2*dx -Ay Ay])
    xlabel(yxL)
    ylabel(yL)

    subplot(s3)
    ploti=zeros([1 l+n1+2]);
    plotit=zeros([1 l+n1+2]);
    for w=1:l+n1+2
        ploti(w)=I(w);
        plotit(w)=It(w);
    end
    plot(plotit,ploti,'k')
    axis([0 ntlep*dt ia im])
    xlabel(s3xL)
    ylabel(s3yL)

    elseif l<2*tx && l>2*ty %x-ben visszafelÈ megy a t^rÈs, y-ban m·r
nincs benne
        subplot(s1)
        plot(x00,Ax*sin(x00*k-omega*l-omega*n1+x1*(1-
dx)*k), 'b', vx1,Ax*sin(vx1*kx+omegax*l+dfix+omega*n1), '--
r', vx2,Ax*sin(vx2*k+omega*l+dfix+omega*n1-(2*x2*(dx-1)-
x1*(dx-1))*k), 'r', x1*dx,Ax*sin(x1*dx*kx+omegax*l+dfix+omega*n1), 'r*')
        axis([x1*dx x2*dx -Ax Ax])
        title(['Id1: ' num2str((n1+l)*dt, '%5.3f') ' ns'])
        xlabel(xxL)
        ylabel(yL)

        subplot(s2)
        plot(x000,Ay*sin(x000*k-omega*l-omega*n1-x1*(1/dx-1)*k
+dfi), 'b', x000,Ay*sin(x000*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)
+x1*(1/dx-1))*k+dfi), 'r', tx1/dx, tfy, 'k', tx2/dx, tfy, 'k', x1/
dx, Ay*sin(x1/dx*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/dx-1))*k
+dfi), 'r*')
        axis([x1*dx x2*dx -Ay Ay])
        xlabel(yxL)
        ylabel(yL)

        subplot(s3)
        ploti=zeros([1 l+n1+2]);
        plotit=zeros([1 l+n1+2]);
        for w=1:l+n1+2
            ploti(w)=I(w);
            plotit(w)=It(w);
        end
        plot(plotit,ploti,'k')
        axis([0 ntlep*dt ia im])

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        xlabel(s3xL)
        ylabel(s3yL)

        elseif l>2*tx && l>2*ty %csak az eredeti hull.mhosszat l.tjuk
            subplot(s1)
            plot(x00,Ax*sin(x00*k-omega*l-omega*n1+x1*(1-
dx)*k), 'b',x00,Ax*sin(x00*k+omega*l+dfix+omega*n1-(2*x2*(dx-1)-
x1*(dx-1))*k), 'r',x1*dx,Ax*sin(x1*dx*k+omega*l+dfix+omega*n1-
(2*x2*(dx-1)-x1*(dx-1))*k), 'r*')
            axis([x1*dx x2*dx -Ax Ax])
            title(['Id1: ' num2str((n1+l)*dt,'%5.3f') ' ns'])
            xlabel(xxL)
            ylabel(yL)

            subplot(s2)
            plot(x000,Ay*sin(x000*k-omega*l-omega*n1-x1*(1/dx-1)*k
+dfi), 'b',x000,Ay*sin(x000*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)
+x1*(1/dx-1))*k+dfi), 'r',tx1/dx,tfy,'k',tx2/dx,tfy,'k',x1/
dx,Ay*sin(x1/dx*k+omega*l+dfiy+omega*n1+(2*x2*(1-1/dx)+x1*(1/dx-1))*k
+dfi), 'r*')
            axis([x1*dx x2*dx -Ay Ay])
            xlabel(yxL)
            ylabel(yL)

            subplot(s3)
            ploti=zeros([1 l+n1+2]);
            plotit=zeros([1 l+n1+2]);
            for w=1:l+n1+2
                ploti(w)=I(w);
                plotit(w)=It(w);
            end
            plot(plotit,ploti,'k')
            axis([0 ntlep*dt ia im])
            xlabel(s3xL)
            ylabel(s3yL)
        end

        pause(.001)
    end

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