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program Laplace
*****
c Este programa resuelve la ecuación de Laplace en 2D
c utilizando el método de relajación y brinda a la
c salida tanto V como el vector E en los puntos de la
c grilla utilizada.
c
c La configuración que se incluye es la de 2 cintas
c conductoras paralelas a potenciales +10V y -10V
c y un conductor circular descargado atrapado entre
c medio de ellas.
c
c La extensión a otras geometrías es directa.
c Sebastian Otranto (2017)
*****

implicit real*8(a-h,o-z)

dimension V(0:45,0:45,0:1)

open(2,file='outVb.dat')
open(3,file='outEb.dat')

do i=0,45
  do j=0,45
    V(i,j,0)=0d0
    V(i,j,1)=0d0
  end do !i
end do !j
write(*,*) 'entro'

c *****Fijo configuración conductores*****
c      0-variable; 1-fijo
c *****
c PLACA IZQUIERDA
c -----
V(10,6,1)=10d0
V(10,7,1)=10d0
V(10,8,1)=10d0
V(10,9,1)=10d0
V(10,10,1)=10d0
V(10,11,1)=10d0
V(10,12,1)=10d0
V(10,13,1)=10d0
V(10,14,1)=10d0
V(10,15,1)=10d0
V(10,16,1)=10d0
V(10,17,1)=10d0
V(10,18,1)=10d0
V(10,19,1)=10d0
V(10,20,1)=10d0
V(10,21,1)=10d0
V(10,22,1)=10d0
V(10,23,1)=10d0
V(10,24,1)=10d0

V(11,6,1)=10d0
V(11,7,1)=10d0
V(11,8,1)=10d0
V(11,9,1)=10d0
V(11,10,1)=10d0
V(11,11,1)=10d0
V(11,12,1)=10d0
V(11,13,1)=10d0

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V(11,14,1)=10d0  
 V(11,15,1)=10d0  
 V(11,16,1)=10d0  
 V(11,17,1)=10d0  
 V(11,18,1)=10d0  
 V(11,19,1)=10d0  
 V(11,20,1)=10d0  
 V(11,21,1)=10d0  
 V(11,22,1)=10d0  
 V(11,23,1)=10d0  
 V(11,24,1)=10d0

V(12,6,1)=10d0  
 V(12,7,1)=10d0  
 V(12,8,1)=10d0  
 V(12,9,1)=10d0  
 V(12,10,1)=10d0  
 V(12,11,1)=10d0  
 V(12,12,1)=10d0  
 V(12,13,1)=10d0  
 V(12,14,1)=10d0  
 V(12,15,1)=10d0  
 V(12,16,1)=10d0  
 V(12,17,1)=10d0  
 V(12,18,1)=10d0  
 V(12,19,1)=10d0  
 V(12,20,1)=10d0  
 V(12,21,1)=10d0  
 V(12,22,1)=10d0  
 V(12,23,1)=10d0  
 V(12,24,1)=10d0

c PLACA DERECHA  
 c -----

V(35,6,1)=-10d0  
 V(35,7,1)=-10d0  
 V(35,8,1)=-10d0  
 V(35,9,1)=-10d0  
 V(35,10,1)=-10d0  
 V(35,11,1)=-10d0  
 V(35,12,1)=-10d0  
 V(35,13,1)=-10d0  
 V(35,14,1)=-10d0  
 V(35,15,1)=-10d0  
 V(35,16,1)=-10d0  
 V(35,17,1)=-10d0  
 V(35,18,1)=-10d0  
 V(35,19,1)=-10d0  
 V(35,20,1)=-10d0  
 V(35,21,1)=-10d0  
 V(35,22,1)=-10d0  
 V(35,23,1)=-10d0  
 V(35,24,1)=-10d0

V(36,6,1)=-10d0  
 V(36,7,1)=-10d0  
 V(36,8,1)=-10d0  
 V(36,9,1)=-10d0  
 V(36,10,1)=-10d0  
 V(36,11,1)=-10d0  
 V(36,12,1)=-10d0  
 V(36,13,1)=-10d0  
 V(36,14,1)=-10d0  
 V(36,15,1)=-10d0  
 V(36,16,1)=-10d0

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V(36,17,1)=-10d0
V(36,18,1)=-10d0
V(36,19,1)=-10d0
V(36,20,1)=-10d0
V(36,21,1)=-10d0
V(36,22,1)=-10d0
V(36,23,1)=-10d0
V(36,24,1)=-10d0

V(37,6,1)=-10d0
V(37,7,1)=-10d0
V(37,8,1)=-10d0
V(37,9,1)=-10d0
V(37,10,1)=-10d0
V(37,11,1)=-10d0
V(37,12,1)=-10d0
V(37,13,1)=-10d0
V(37,14,1)=-10d0
V(37,15,1)=-10d0
V(37,16,1)=-10d0
V(37,17,1)=-10d0
V(37,18,1)=-10d0
V(37,19,1)=-10d0
V(37,20,1)=-10d0
V(37,21,1)=-10d0
V(37,22,1)=-10d0
V(37,23,1)=-10d0
V(37,24,1)=-10d0

write(*,*) 'relajo'

do N=1,100000

if(mod(N,1000).eq.0) write(*,*) N

do i=1,44
do j=1,44

Vleft=V(i-1,j,0)
Vright=V(i+1,j,0)
Vtop=V(i,j+1,0)
Vbottom=V(i,j-1,0)

if (V(i-1,j,1).ne.0d0) Vleft=V(i-1,j,1)
if (V(i+1,j,1).ne.0d0) Vright=V(i+1,j,1)
if (V(i,j+1,1).ne.0d0) Vtop=V(i,j+1,1)
if (V(i,j-1,1).ne.0d0) Vbottom=V(i,j-1,1)

V(i,j,0)=(1d0/4d0)*(Vleft+Vright+Vtop+Vbottom)

V(20,15,0)=V(20,14,0) !CONDUCTOR EN EL CENTRO
V(20,16,0)=V(20,14,0) !(Condición de Dirichlet)
V(21,13,0)=V(20,14,0) !
V(21,14,0)=V(20,14,0) !
V(21,15,0)=V(20,14,0) !
V(21,16,0)=V(20,14,0) !
V(21,17,0)=V(20,14,0) !
V(22,12,0)=V(20,14,0) !
V(22,13,0)=V(20,14,0) !
V(22,14,0)=V(20,14,0) !
V(22,15,0)=V(20,14,0) !
V(22,16,0)=V(20,14,0) !
V(22,17,0)=V(20,14,0) !
V(22,18,0)=V(20,14,0) !
V(23,12,0)=V(20,14,0) !

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V(23,13,0)=V(20,14,0) !
V(23,14,0)=V(20,14,0) !
V(23,15,0)=V(20,14,0) !
V(23,16,0)=V(20,14,0) !
V(23,17,0)=V(20,14,0) !
V(23,18,0)=V(20,14,0) !
V(24,12,0)=V(20,14,0) !
V(24,13,0)=V(20,14,0) !
V(24,14,0)=V(20,14,0) !
V(24,15,0)=V(20,14,0) !
V(24,16,0)=V(20,14,0) !
V(24,17,0)=V(20,14,0) !
V(24,18,0)=V(20,14,0) !
V(25,13,0)=V(20,14,0) !
V(25,14,0)=V(20,14,0) !
V(25,15,0)=V(20,14,0) !
V(25,16,0)=V(20,14,0) !
V(25,17,0)=V(20,14,0) !
V(26,14,0)=V(20,14,0) !
V(26,15,0)=V(20,14,0) !
V(26,16,0)=V(20,14,0) !
end do !i
end do !j

do l=0,45
V(0,l,0)=V(1,l,0) ! Eperp = 0 en los bordes
V(45,l,0)=V(44,l,0) ! (Condición de Neumann)
V(l,0,0)=V(l,1,0) !
V(l,45,0)=V(l,44,0) !
end do !l

end do !N

do i=0,45 !Escribo V para cada punto de la grilla
do j=0,45
write(2,*) i,j,V(i,j,0)
end do
end do

do i=0,44 !Cálculo del vector E
do j=0,44
Ex=-(V(i+1,j,0)-V(i,j,0))/1d0
Ey=-(V(i,j+1,0)-V(i,j,0))/1d0
c write(3,25) i,j,Ex,Ey
if((Ex.eq.0d0).and.(Ey.eq.0)) goto 30
write(3,25) i,j,1d0*i+Ex,1d0*j+Ey !Escribo el vector E
25 format (1x,i2,1x,i2,2f9.4) !para un gráfico de
30 continue !vectores con qtiplot
end do
end do

close(2)
close(3)
end

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