Computer Programming for Geosciences (GS543)

Tutorial-1

An inclined sheet-type structure (Figure 1) in two dimensions can be described by a set of five model parameters, namely, electric dipole density $k = I\rho/2\pi$ (I is the current density of the medium and ρ is the resistivity of the sheet), x coordinate of the center of the sheet x_0, depth of the center of the sheet h, half-width of the sheet a and inclination angle α.

The general equation of SP anomaly $V(x)$ at any point P on a profile perpendicular to the strike of a 2-D inclined sheet is written as:

$$V(x) = k \ln \left[\frac{\{(x-x_0)-a\cos\alpha\}^2+(h-a\sin\alpha)^2}{\{(x-x_0)+a\cos\alpha\}^2+(h+a\sin\alpha)^2}\right]. \quad (1)$$

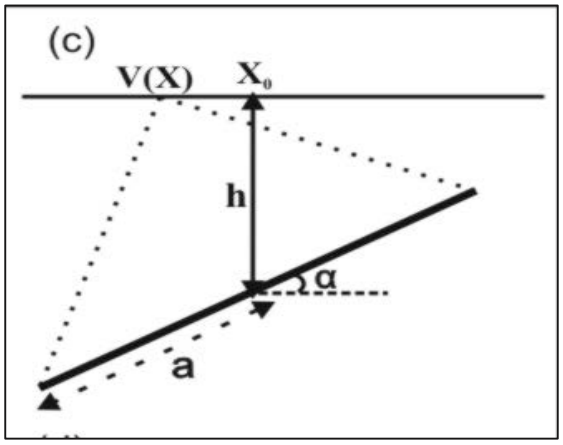


Figure 1: Geometrical shaped body- 2D Inclined Sheet geometry.

Write down a **Fortran program** to compute the SP response using the equation 1 and complete the table accordingly:

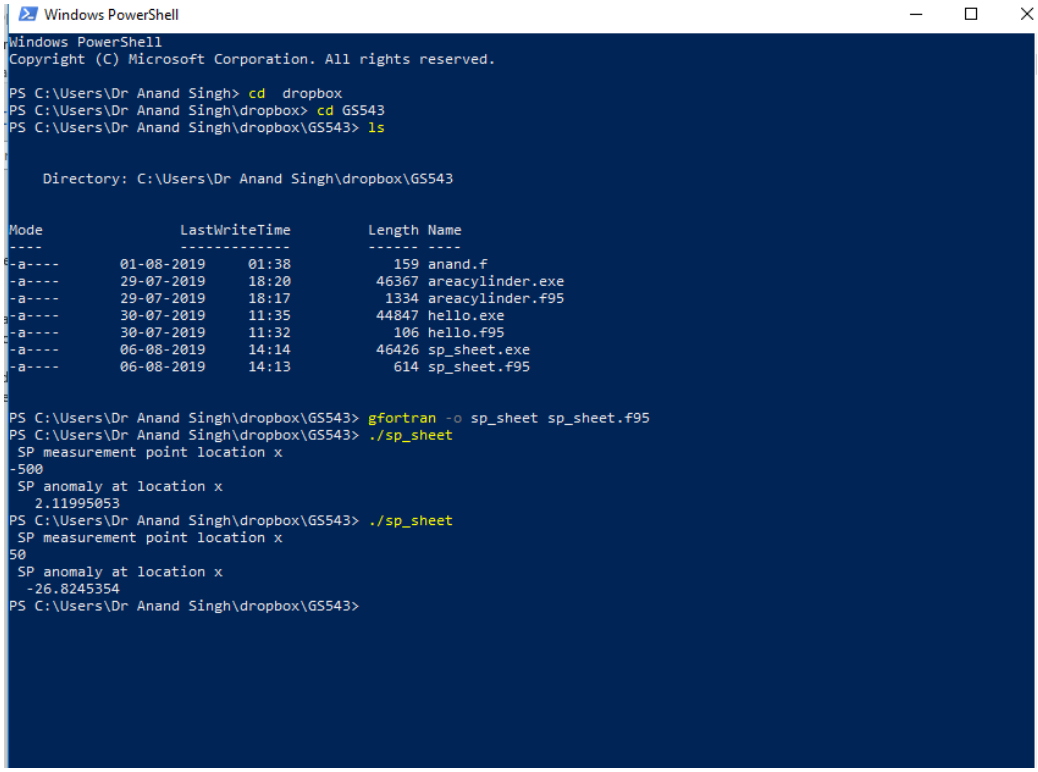
x (m)	V (mv)	x (m)	V (mv)
-500		50	
-400		100	
-300		200	
-200		300	
-100		400	
-50		500	
0		-	

Program Script

```
! Program to compute SP anomaly over thin sheet
  Program sheet_sp
  implicit none    ! Require all variables to be explicitly declared
  real :: k,xo,a,alpha,h,x,v
  real :: num1,num2,deno1,deno2,deno, num
   k=40.0
   xo=0.0
   a=10.0
   alpha=3.14/4  ! in radian
   h=30.0
  write(*,*) "SP measurement point location x"
  read(*,*) x
  num1=((x-xo)-a*cos(alpha))**2
  num2=(h-a*sin(alpha))**2
  num=num1+num2
  deno1=((x-xo)+a*cos(alpha))**2
  deno2=(h+a*sin(alpha))**2
  deno=deno1+deno2
  v=k*log(num/deno)
  write(*,*) "SP anomaly at location x"
  write(*,*) v

  end program sheet_sp
```

Compilation and Execution


Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
PS C:\Users\Dr Anand Singh> cd dropbox
PS C:\Users\Dr Anand Singh\dropbox> cd GS543
PS C:\Users\Dr Anand Singh\dropbox\GS543> ls
Directory: C:\Users\Dr Anand Singh\dropbox\GS543
Mode LastWriteTime Length Name
---- ------------- ------ ----
-a---- 01-08-2019 01:38 159 anand.f
-a---- 29-07-2019 18:20 46367 areacylinder.exe
-a---- 29-07-2019 18:17 1334 areacylinder.f95
-a---- 30-07-2019 11:35 44847 hello.exe
-a---- 30-07-2019 11:32 106 hello.f95
-a---- 06-08-2019 14:14 46426 sp_sheet.exe
-a---- 06-08-2019 14:13 614 sp_sheet.f95
PS C:\Users\Dr Anand Singh\dropbox\GS543> gfortran -o sp_sheet sp_sheet.f95
PS C:\Users\Dr Anand Singh\dropbox\GS543> ./sp_sheet
SP measurement point location x
-500
SP anomaly at location x
2.11995053
PS C:\Users\Dr Anand Singh\dropbox\GS543> ./sp_sheet
SP measurement point location x
50
SP anomaly at location x
-26.8245354
PS C:\Users\Dr Anand Singh\dropbox\GS543>

```
! Program to compute SP anomaly over thin sheet
  Program sheet_sp
 ! implicit none    ! Require all variables to be explicitly declared
  real :: k,xo,a,alpha,h,x,v,pai
  real :: num1,num2,deno1,deno2,deno, num
  character :: yn
  pai=3.141592653589793
   k=40.0
   xo=0.0
   a=10.0
   alpha=45*pai/180  ! in radian
   h=30.0

  interactive_loop: do

  write(*,*) "SP measurement point location x"
  read(*,*) x
  num1=((x-xo)-a*cos(alpha))**2
  num2=(h-a*sin(alpha))**2
  num=num1+num2
  deno1=((x-xo)+a*cos(alpha))**2
  deno2=(h+a*sin(alpha))**2
  deno=deno1+deno2
  v=k*log(num/deno)
  write(*,*) "SP anomaly at location x"
  write(*,*) v
  yn = ' '
  yn_loop: do
  write(*,*) 'Perform another calculation? y[n]'
      read(*,'(a1)') yn
      if (yn=='y' .or. yn=='Y') exit yn_loop
      if (yn=='n' .or. yn=='N' .or. yn==' ') exit interactive_loop
  end do yn_loop

  end do interactive_loop
  end program sheet_sp
```