# Results

## Uniform grids



Figure uniform grids

## Stretched grids



Figure 2 stretched grids when a=2



Figure 3 stretched grids when a=6



Figure 4 stretched grids when a=10

# Codes

program grid

C.. This codes is to solve the 11th CFD homework

C.. Both uniform and stretched grids are developed

implicit none

C.. Define Variables

C.. mesh size in x and y

integer imax, jmax, case\_no, i,j,k

C.. matrix used to store the coordinates

double precision x(100,100), y(100,100), x\_temp, y\_temp

C.. coefficient in stretched grids formulation

double precision a

double precision pi

C.. geometry

double precision sita, beta, l\_1, l\_2, l\_3, x\_t

double precision y\_t, x\_c, y\_c, r\_c, h\_i

C.. initialize the data

parameter (imax=51, jmax=25)

parameter (pi=3.1415926)

parameter (sita=-22.33/360\*2\*pi,beta=1.21/360\*2\*pi)

parameter (l\_1=4.74, l\_2=5.84, l\_3=11.56, x\_t=5.84)

parameter (y\_t=1.37, x\_c=5.78, y\_c=4.11, r\_c=2.74, h\_i=3.52)

C.. input the case no

write (6, \*) 'please input the case no'

write (6, \*) '1: uniform; 2: stretched'

read (5, \*) case\_no

C.. calculate the coordinates

select case (case\_no)

! uniform grids

case (1)

! coordinates in x

do i=1, imax+1

do j=1, jmax+1

x(i,j)=(i-1)\*l\_3/imax

end do

end do

! calculate y and the coordinates as x

do i=1, imax+1

x\_temp=x(i,1)

if (x\_temp>=0 .and. x\_temp<=l\_1) then

do j=1, jmax+1

y\_temp=tan(sita)\*x\_temp+h\_i

y(i,j)=(j-1)\*y\_temp/jmax

end do

else if (x\_temp>=l\_1 .and. x\_temp<=l\_2) then

do j=1, jmax+1

y\_temp=-1\*sqrt(r\_c\*\*2-(x\_temp-x\_c)\*\*2)+y\_c

y(i,j)=(j-1)\*y\_temp/jmax

end do

else

do j=1, jmax+1

y\_temp=tan(beta)\*(x\_temp-x\_t)+y\_t

y(i,j)=(j-1)\*y\_temp/jmax

end do

end if

end do

! stretched grids

case (2)

! input the coefficient for equation generating stretched grids

write (6,\*) 'input equation coefficient a'

read (5,\*) a

! coordinates in x

do i=1, imax+1

do j=1, jmax+1

x(i,j)=(i-1)\*l\_3/imax

end do

end do

! calculate y and the coordinates as x

do i=1, imax+1

x\_temp=x(i,1)

if (x\_temp>=0 .and. x\_temp<=l\_1) then

y\_temp=tan(sita)\*x\_temp+h\_i

do j=1, jmax+1

y(i,j)=y\_temp-(real(j-1)/jmax)\*\*a\*y\_temp

end do

else if (x\_temp>=l\_1 .and. x\_temp<=l\_2) then

y\_temp=-1\*sqrt(r\_c\*\*2-(x\_temp-x\_c)\*\*2)+y\_c

do j=1, jmax+1

y(i,j)=y\_temp-(real(j-1)/jmax)\*\*a\*y\_temp

end do

else

y\_temp=tan(beta)\*(x\_temp-x\_t)+y\_t

do j=1, jmax+1

y(i,j)=y\_temp-(real(j-1)/jmax)\*\*a\*y\_temp

end do

end if

end do

case default

write (6, \*) 'Error with the case input'

end select

C.. output data in Tecplot format

open (1,file='results.plt', status='unknown')

C.. write the title of the figure

write (1,\*) "variable= x, y"

write (1,\*) "ZONE I=52, J=26, F=POINT"

C.. output data line by line

do j=1, jmax+1

do i=1, imax+1

write (1,\*) x(i,j), y(i,j)

end do

end do

C.. end the program

end