**TUTORIAL-5**

**Name-Anshul**

**Roll no –M22ME052**

1 matlab code:-

clear all;

close all;

clc;

%%

U=1;

gamma=input("input the value of circulation or gamma = ");

k=input("input the doublet strength = ");

ro=1.21;

alpha=0;

a=sqrt(k/(2\*pi\*U));

%%

syms r theta

z=r.\*exp(theta\*i)\*exp(-alpha\*i);

F=U\*(z+a^2./z)-log(z).\*(gamma/(2\*pi))\*i;

% W=diff(F);

W=U\*(1-a^2./z.^2)-(gamma./(2\*pi\*z))\*i;

% I=int(0.5\*ro\*i\*W.^2,theta,[0,2\*pi]);

% A=real(double(I));

% N=-imag(double(I));

B1=gamma\*i\*exp(-alpha\*i);

G=-U\*ro\*B1;

A=real(G);

N=-imag(G);

B=[cos(alpha),-sin(alpha);sin(alpha),cos(alpha)]\*[N;A];

L=B(1);

D=B(2);

phi=real(F);

shi=imag(F);

u\_r=real(W./exp(-theta\*i));

u\_theta=-imag(W./exp(-theta\*i));

u\_theta\_f=matlabFunction(u\_theta);

u\_r\_f=matlabFunction(u\_r);

%%

%location of stagnation

eqns=u\_r==0;

s1=solve(eqns,[r,theta]);

r\_s=double(s1.r);

eqns=u\_theta\_f(abs(r\_s(1)),theta)==0;

s2=solve(eqns,theta);

theta\_s=abs(double(s2))\*180/pi;

beta=asin(gamma/(4\*pi\*a\*U))\*(180/pi);

%%

%streamline,velocity,pressure and force

shi\_f=matlabFunction(shi);

p=linspace(0,3);

q=linspace(0,2\*pi);

[r,theta]=meshgrid(p,q);

figure(1);

contour(r.\*cos(theta),r.\*sin(theta),shi\_f(r,theta),101);

title("streamline");

figure(2);

t=0:pi/120:2\*pi;

cp=1-4\*(sin(t)-sin(beta\*pi/180)).^2;

plot(t,cp);

title("pressure variation");

xlabel("--- theta --->");

ylabel("---- cp ---->");

syms t

cp=1-4\*(sin(t)-sin(beta\*pi/180)).^2;

J1=matlabFunction(cp.\*sin(t));

J2=matlabFunction(cp.\*cos(t));

I1=int(J1,t,[0,2\*pi]);

I2=int(J2,t,[0,2\*pi]);

Fy=0.5\*ro\*a\*U^2\*double(I1);

Fx=0.5\*ro\*a\*U^2\*double(I2);

figure(3);

t=0:pi/120:2\*pi;

v=sqrt((u\_r\_f(a,t)).^2+(u\_theta\_f(a,t)).^2);

plot(t,v);

title("velocity");

xlabel("----- theta --->");

ylabel("----- velocity --->");

**Result:-**

1. **No circulation**

Assume Doublet strength =2\*pi

Assume Alpha (AOA)=0

**Result:-**

**Stagnation point**

R\_S= -1 and 1

Theta\_s=beta=0

**Force**

Fx=0

Fy=0

N=0

A=0

L=0

D=0

Streamline

****

Velocity variation

****

Cp variation



1. **Finite circulation**

Assume Doublet strength =2\*pi

Assume Alpha (AOA)=0

**Result:-**

1. **Gamma=2\*pi**

**Gamma/(4\*Pi\*a\*U) < 1**

**Stagnation point**

R\_S= -0.865879008324549 + 0.499746521308551i

And 0.865879008324549 + 0.499746521308551i

Theta\_s=beta= 30 and 150

**Force**

Fx=0

Fy=7.5988

N=7.5988

A=0

L=7.5988

D=0

**Streamline**

****

**Velocity variation**

****

**Cp variation**

****

1. **Gamma = 2\*pi**

**Gamma/(4\*Pi\*a\*U) = 1**

**Stagnation point**

R\_S= 0+1i

Theta\_s=beta= 90

**Force**

Fx=0

Fy=15.2053

N=15.2053

A=0

L=15.2053

D=0

**Streamline**

****

**Velocity variation**

****

**Cp variation**

****

1. **Gamma = 6\*pi**

**Gamma/(4\*Pi\*a\*U) > 1**

**Stagnation point**

R\_S= 0.000000000000000 + 2.618033988749895i

Theta\_s=beta= 90.000000000000000 - 55.142813255405970i

**Force**

Fx=0

Fy= 22.8079626650618

N=22.8080

A=0

L=22.8080

D=0

Streamline



Velocity variation



Cp variation

****