**TUTORIAL-3**

**Name-Anshul**

**Roll no –M22ME052**

1

1. Constant source

**Matlab code :-**

close all;

clear all;

clc;

%%

%constant constant source strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength of panel = ');

% g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;

%%

%velocity at any point P(x,y)

[ux,uz]=constantsource\_velolcity(x1,z1,x2,z2,g,n,g1);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=constantsource\_potential(x1,z1,x2,z2,g,n,g1);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**Velocity function matlab:-**

function [ux,uz]=constantsource\_velolcity(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[0.5\*log(((g-x1)^2+n^2)/((g-x2)^2+n^2));atan2(n,(g-x2))-atan2(n,(g-x1))];

U=T\*A;

ux=U(1);

uz=U(2);

**potential function matlab:-**

function [phi\_s]=constantsource\_potential(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[0.5\*log(((g-x1)^2+n^2)/((g-x2)^2+n^2));atan(n/(g-x2))-atan(n/(g-x1))];

U=T\*A;

ux=U(1);

uz=U(2);

phi\_s=int(uz,'n');

**Result :-**

**At point P(1,1)**

Ux\_P=0.0552

Uz\_p=0.1250

Phi\_p=0.1802







****

****

1. **Linear source**

**Matlab code:-**

close all;

clear all;

clc;

%%

%linear source strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength at left edge of panel = ');

g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;g2=2;

%%

%velocity at any point P(x,y)

[ux,uz]=linearsource\_velolcity(x1,z1,x2,z2,g,n,g1,g2);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=linearsource\_potential(x1,z1,x2,z2,g,n,g1,g2);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**Velocity function matlab:-**

function [ux,uz]=linearsource\_velolcity(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=atan2(n\*l,g^2+n^2-l\*g);

B=0.5\*log((n^2+g^2)/((g-l)^2+n^2));

p=[(l-g)\*B-n\*A+l,n\*A+g\*B-l;n\*B+(l-g)\*A,-n\*B+g\*A];

P=(1/(2\*pi\*l))\*T\*p;

U=P\*[g1,g2]';

ux=U(1);

uz=U(2);

**potential function matlab:-**

function [phi\_s]=linearsource\_potential(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=atan(n\*l/(g^2+n^2-l\*g));

B=0.5\*log((n^2+g^2)/((g-l)^2+n^2));

p=[(l-g)\*B-n\*A+l,n\*A+g\*B-l;n\*B+(l-g)\*A,-n\*B+g\*A];

P=(1/(2\*pi\*l))\*T\*p;

U=P\*[g1,g2]';

ux=U(1);

uz=U(2);

phi\_s=int(uz,'n');

**Result:-**

**At point(1,1)**

Ux\_P=0.0762

Uz\_p=0.1948

Phi\_p=0.3052









****

1. **Constant vortex:-**

**Matlab code:-**

close all;

clear all;

clc;

%%

%constant constant vortex strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength of panel = ');

% g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;

%%

%velocity at any point P(x,z)

[ux,uz]=constantvortex\_velolcity(x1,z1,x2,z2,g,n,g1);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=constantvortex\_potential(x1,z1,x2,z2,g,n,g1);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**velocity function matlab:-**

function [ux,uz]=constantvortex\_velolcity(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[atan2(n,(g-x2))-atan2(n,(g-x1));0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2))];

U=T\*A;

ux=U(1);

uz=U(2);

**potential function matlab:-**

function [phi\_s]=constantvortex\_potential(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[atan(n/(g-x2))-atan(n/(g-x1));0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2))];

U=T\*A;

ux=U(1);

uz=U(2);

phi\_s=int(ux,'g');

**Result:-**

**At point P(1,1)**

**Ux\_p=0.1250**

**Uz\_P=-0.0552**

**Phi\_p=0.0698**

****

****

****

****

1. **Linear vortex:-**

**Matlab code:-**

close all;

close all;

clear all;

clc;

%%

%constant linear vortex strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength at left edge of panel = ');

g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;g2=2;

%%

%velocity at any point P(x,z)

[ux,uz]=linearvortex\_velolcity(x1,z1,x2,z2,g,n,g1,g2);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=linearvortex\_potential(x1,z1,x2,z2,g,n,g1,g2);

% a=phi(1,1);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**Velocity function matlab code:-**

function [ux,uz]=linearvortex\_velolcity(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

A=atan2(n\*l,g^2+n^2-l\*g);

B=0.5\*log((n^2+g^2)/((g-l)^2+n^2));

T=(1/l)\*[dx,-dz;dz,dx];

p=[(l-g)\*A+n\*B,g\*A-n\*B;n\*A-(l-g)\*B-l,-n\*A-g\*B+l];

P=(1/(2\*pi\*l))\*T\*p;

U=P\*[g1,g2]';

ux=U(1);

uz=U(2);

**potential function matlab code:-**

function [phi\_s]=linearvortex\_potential(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

A=atan(n\*l/(g^2+n^2-l\*g));

B=0.5\*log((n^2+g^2)/((g-l)^2+n^2));

T=(1/l)\*[dx,-dz;dz,dx];

p=[(l-g)\*A+n\*B,g\*A-n\*B;n\*A-(l-g)\*B-l,-n\*A-g\*B+l];

P=(1/(2\*pi\*l))\*T\*p;

U=P\*[g1,g2]';

uz=U(2);

phi\_s=int(uz,'n');

% a=matlabFunction(I\_uz);

% phi=a(g,n);

**Result:-**

**At point P(1,1)**

**Ux\_P=0.1948**

**Uz\_p=-0.0762**

**Phi\_P=-0.3274**

****

****

****

****

****

1. **Constant doublet**

**Matlab code:-**

close all;

close all;

clear all;

clc;

%%

% constant doublet strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength of panel = ');

% g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;

%%

%velocity at any point P(x,y)

[ux,uz]=constantdoublet\_velolcity(x1,z1,x2,z2,g,n,g1);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=constantdoublet\_potential(x1,z1,x2,z2,g,n,g1);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**Velocity function matlab code:-**

function [ux,uz]=constantdoublet\_velolcity(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[-(n/((g-x1)^2+n^2)-n/((g-x2)^2+n^2));((g-x1)/((g-x1)^2+n^2)-(g-x2)/((g-x2)^2+n^2))];

U=T\*A;

ux=U(1);

uz=U(2);

**potential function matlab code:-**

function [phi\_s]=constantdoublet\_potential(x1,z1,x2,z2,g,n,g1)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=(0.5\*g1/pi)\*[-(n/((g-x1)^2+n^2)-n/((g-x2)^2+n^2));((g-x1)/((g-x1)^2+n^2)-(g-x2)/((g-x2)^2+n^2))];

U=T\*A;

ux=U(1);

uz=U(2);

phi\_s=int(uz,'n');

**Result:-**

**At point P(1,1)**

**Ux\_p=0.0796**

**Uz\_p=0.0796**

**Phi\_P=-0.1250**

****

****

****

****

****

**(vi)linear doublet :-**

**matlab code:-**

close all;

clear all;

clc;

%%

%linear doublet strength

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

g1=input('strength at left edge of panel = ');

g2=input('strength at right edge of panel = ');

% x1=0;z1=0;x2=1;z2=0;g=1;n=1;g1=1;g2=2;

%%

%velocity at any point P(x,y)

[ux,uz]=lineardoublet\_velolcity(x1,z1,x2,z2,g,n,g1,g2);

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

x=(x1+x2)/2;

z=-10:0.1:10;

ux=vel\_fx(x,z);

uz=vel\_fz(x,z);

figure(1)

plot(z,ux);

hold on;

plot(z,uz);

xlabel('--- x and z -->');

ylabel('--- ux and uz -->');

legend('ux','uz');

title('variation of ux,uz along central normal line of panel');

x=x1:0.1:x2;

ux=vel\_fx(x,0);

figure(2)

plot(x,ux);

xlabel('--- x -->');

ylabel('--- ux -->');

title('variation of ux at z=0, along panel length');

uz=vel\_fz(x,0);

figure(3)

plot(x,uz);

xlabel('--- x -->');

ylabel('--- uz -->');

title('variation of uz at z=0, along panel length');

%%

%potential at a point

[phi\_s]=lineardoublet\_potential(x1,z1,x2,z2,g,n,g1,g2);

phi\_f=matlabFunction(phi\_s);

phi\_P=phi\_f(g,n);

x=x1:0.1:x2;

phi=phi\_f(x,0);

figure(4)

plot(x,phi);

xlabel('--- x -->');

ylabel('--- phi -->');

title('variation of phi at z=0, along panel length');

x=(x1+x2)/2;

z=-10:0.1:10;

phi=phi\_f(x,z);

figure(5)

plot(z,phi);

xlabel('--- z -->');

ylabel('--- phi -->');

title('variation of phi along central normal line of panel');

**Velocity function matlab code:-**

function [ux,uz]=lineardoublet\_velolcity(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

a=-(atan2(n,(g-x2))-atan2(n,(g-x1)));

b=n/((g-x1)^2+n^2);

c=n/((g-x2)^2+n^2);

d=(g-x1)/((g-x1)^2+n^2);

e=(g-x2)/((g-x2)^2+n^2);

f=-(0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2)));

D=(1/(2\*pi))\*[-b+c-a-x2\*c+x1\*b,-(-a-x2\*c+x1\*b);d-e-f-x1\*d+x2\*e,-(-f-x1\*d+x2\*e)]\*[g1,g2]';

% A=[-(g1/(2\*pi))\*(n/((g-x1)^2+n^2)-n/((g-x2)^2+n^2))+((g2-g1)/(2\*pi))\*(-(atan2(n,(g-x2))-atan2(n,(g-x1)))+(x2\*n/((g-x2)^2+n^2))-(x1\*n/((g-x1)^2+n^2)));(g1/(2\*pi))\*((g-x1)/((g-x1)^2+n^2)-(g-x2)/((g-x2)^2+n^2))+((g2-g1)/(2\*pi))\*(-(0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2)))+(x1\*(g-x1)/((g-x1)^2+n^2))-(x2\*(g-x2)/((g-x2)^2+n^2)))];

U=T\*D;%U=T\*A

ux=U(1);

uz=U(2);

**potential function matlab code:-**

function [phi\_s]=lineardoublet\_potential(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

a=-(atan(n/(g-x2))-atan(n/(g-x1)));

b=n/((g-x1)^2+n^2);

c=n/((g-x2)^2+n^2);

d=(g-x1)/((g-x1)^2+n^2);

e=(g-x2)/((g-x2)^2+n^2);

f=-(0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2)));

D=(1/(2\*pi))\*[-b+c-a-x2\*c+x1\*b,-(-a-x2\*c+x1\*b);d-e-f-x1\*d+x2\*e,-(-f-x1\*d+x2\*e)]\*[g1,g2]';

% A=[-(g1/(2\*pi))\*(n/((g-x1)^2+n^2)-n/((g-x2)^2+n^2))+((g2-g1)/(2\*pi))\*(-(atan(n/(g-x2))-atan(n/(g-x1)))+(x2\*n/((g-x2)^2+n^2))-(x1\*n/((g-x1)^2+n^2)));(g1/(2\*pi))\*((g-x1)/((g-x1)^2+n^2)-(g-x2)/((g-x2)^2+n^2))+((g2-g1)/(2\*pi))\*(-(0.5\*log(((g-x2)^2+n^2)/((g-x1)^2+n^2)))+(x1\*(g-x1)/((g-x1)^2+n^2))-(x2\*(g-x2)/((g-x2)^2+n^2)))];

U=T\*D;%U=T\*A

ux=U(1);

uz=U(2);

phi\_s=int(ux,'g');

**result:-**

**at point P(1,1)**

**ux\_p=0.1137**

**uz\_p=0.1347**

**phi\_p=-0.3997**

****

****

****

****

****

**2**

**Matlab code:-**

close all;

clear all;

clc;

%%

%

u0=1;

N=input('number of panel = ');

g=input('x co-ordinate of point where you want to calculate any parameter = ');

n=input('z co-ordinate of point where you want to calculate any parameter = ');

% g=1;n=1;

ux\_n=0;

uz\_n=0;

for i=1:N

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

g1=input('strength at left edge of panel = ');

g2=input('strength at right edge of panel = ');

fprintf('\n');

[ux,uz]=linearsource\_velolcity(x1,z1,x2,z2,g,n,g1,g2);

ux=ux+ux\_n;

ux\_n=ux;

uz=uz+uz\_n;

uz\_n=uz;

end

vel\_fx=matlabFunction(ux);

vel\_fz=matlabFunction(uz);

ux\_P=u0+vel\_fx(g,n);

uz\_p=vel\_fz(g,n);

%enter the edge coordinate of panel where you wanted to findout normal and

%tangential velocity

fprintf('enter the edge coordinate of panel where you wanted to findout normal and tangential velocity \n');

x1=input('enter the panel left edge x co-ordinate = ');

z1=input('enter the panel left edge z co-ordinate = ');

x2=input('enter the panel right edge x co-ordinate = ');

z2=input('enter the panel right edge z co-ordinate = ');

xc=(x1+x2)/2;

zc=(x1+x2)/2;

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

ux\_P=u0+vel\_fx(xc,zc);

uz\_p=vel\_fz(xc,zc);

u\_n=[ux\_P,uz\_p]\*[dx/l,dz/l]';

u\_t=[ux\_P,uz\_p]\*[dx/l,-dz/l]';

**Velocity function matlab:-**

function [ux,uz]=linearsource\_velolcity(x1,z1,x2,z2,g,n,g1,g2)

dx=x2-x1;

dz=z2-z1;

l=sqrt(dx^2+dz^2);

syms g n

T=(1/l)\*[dx,-dz;dz,dx];

A=atan2(n\*l,g^2+n^2-l\*g);

B=0.5\*log((n^2+g^2)/((g-l)^2+n^2));

p=[(l-g)\*B-n\*A+l,n\*A+g\*B-l;n\*B+(l-g)\*A,-n\*B+g\*A];

P=(1/(2\*pi\*l))\*T\*p;

U=P\*[g1,g2]';

ux=U(1);

uz=U(2);

**Result:-**

**at point P(1,1):**

**ux\_p=1.1997**

**uz\_p=1.6103**

**at center of panel (2,2) to (3,3)**

**u\_n=1.4668**

**u\_t=0.5156**

**at center of panel (3,3) to (4,3)**

**u\_n=0.4373**

**u\_t=1.3426**

**at center of panel (4,3) to (5,2)**

**u\_n=-0.6846**

**u\_t=1.1305**

**at center of panel (2,2) to (5,2)**

**u\_n=0.4373**

**u\_t=1.3426**