PHYSICAL INTEPRETATION

OBJECTIVE:

To observe the flow pattern in the field through a 2D channel with boundary conditions such as incompressibility, inviscidity and irrotational flow. Then derivative for the potential Φ are plotted in the x direction (Vx) and y direction (Vy) using the central difference equations.

PHYSICAL INTERPRETATION:

For the first level of resolution or coarse grid we discretize the flow field to get grid with size 0.04 whereas for second level of resolution or fine grid we discretize it to get grid width 0.02. We take the fine grid to increase the resolution and accuracy of the result.

Baseline solution:

We have forced initial conditions only on the boundary PQ also the boundary RS is free.

(M=11, N=26)[First level of resolution]:

From the graph we observe that,

Vx: along i=2, we get a parabola due to initial conditions which we force on the flow.

Along i= (N-1/2) +1 and N-1, we get a trapezium because of the absence of viscosity i.e. inviscidity of the fluid (absence of no slip condition).

Vy: We expect to observe a straight line at 0 for all the points instead we got a slight glitch at the starting points as instead of taking the infinite points that are there in a flow field we take only finite discrete points.

We get the velocity graphs as negative because the conditions implied flow in the negative direction. (4.0\*((10-b)\*0.04)\*(((10-b)\*0.04)-0.4))

(M=21, N=51)[Second level of resolution]:

We observe plots of Vx, Vy similar to that of first level of resolution but with better resolution.

Specific Solution:

In the specific solution the conditions that we apply at the boundaries have an amplitude increase from the boundary PQ to the boundary RS. This is possible only if there is an inflow from the free boundary at the bottom.

(M=11, N=26) [Coarse Grid]:

Vx: We see that along i=2, we get a parabola due to forced initial conditions that we apply on the flow.

Along i= (N-1/2) +1 and N-1, we get a negative graph, a distorted parabola because of the external flow from the free boundary wall. As the amplitude was magnified we deduced that velocity was increased due to external flow.

Vy:

We get certain peaks due to error and discretization of the flow field.

(M=21, N=51) [Fine Grid]:

We observe the same graphs as that in the coarse grid case but with better resolution.