FINITE ELEMENTS IN FLUIDS

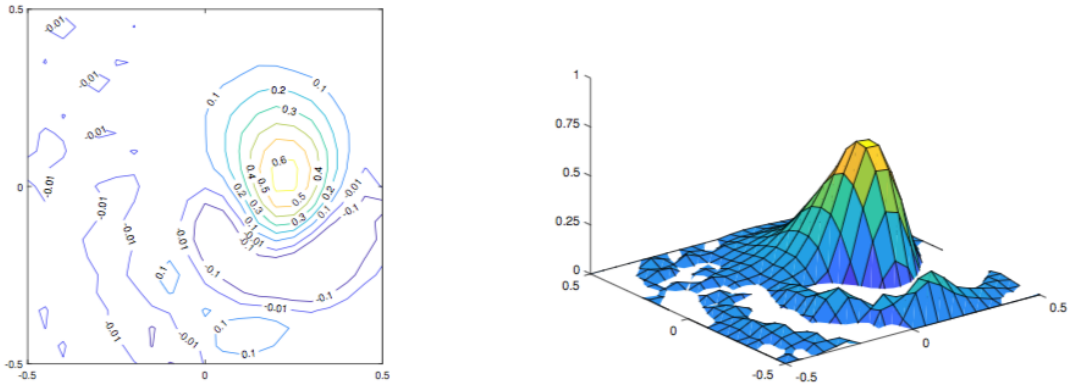
Assignment 3: 2D Unsteady Convection and Diffusion

Implementation of TG4 2 Steps

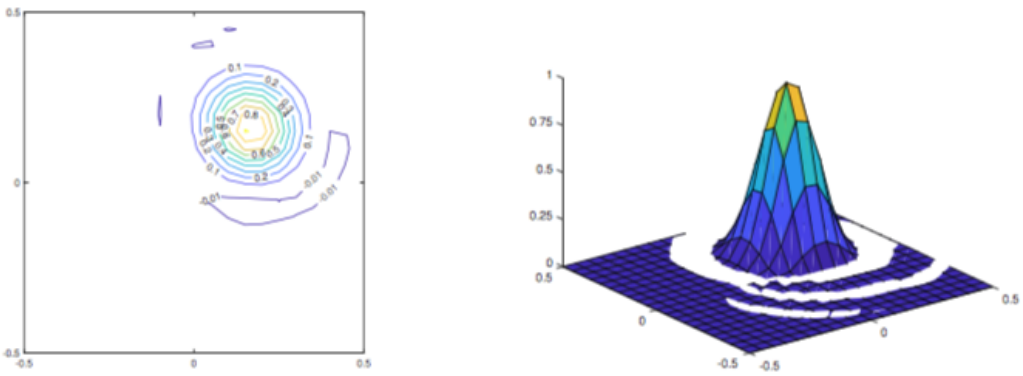
In this assignment we are asked to implement a 4th order method and we are going to implement Taylor Galerkin 4th order 2 steps such as:

```
elseif meth == 8 %TG4 2 steps
    A1 = M; %1st step A matrix
    %1st step B matrix
    B1 = (1/3)*C*dt + (1/12)*Co*dt^2 - (1/3)*Mo*dt - (1/12)*K*dt^2;
    %1st step force vector
    f1 = (1/3)*dt*v1 - (1/12)*vo*dt^2 + (1/12)*v2*dt^2;
    A2 = M; %2nd step A matrix
    % 2nd step B matrix
    B2 = C*dt - Mo*dt;
    % 2nd step C matrix
    C2 = -(1/2)*K*dt^2 + (1/2)*Co*dt^2
    % 2nd step force vector
    f2 = v1*dt + (1/2)*v2*dt^2 - (1/2)*vo*dt^2
```

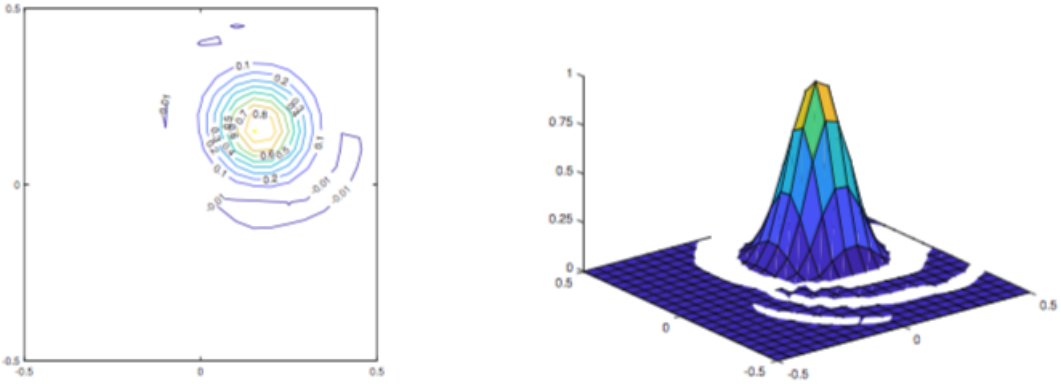
Results after the implementation:



In this figure we can see the implementation of CN + Galerkin with Lumped Mass matrix



In this previous figure we it is shown the result for the implementation of TG3 2 steps.



In this previous figure we it is shown the result for the implementation of TG4 2 steps.

As we can appreciate, the 2 bottom figures have an incredible similarity because they both are TG with 2 steps, the difference is that the upper one is just 3th order, compared to the 4th order that follows. What we can say is that these lasts methos are much more accurate than the CN + Galerking with lumped mass. It is clearly a much less stable solution.