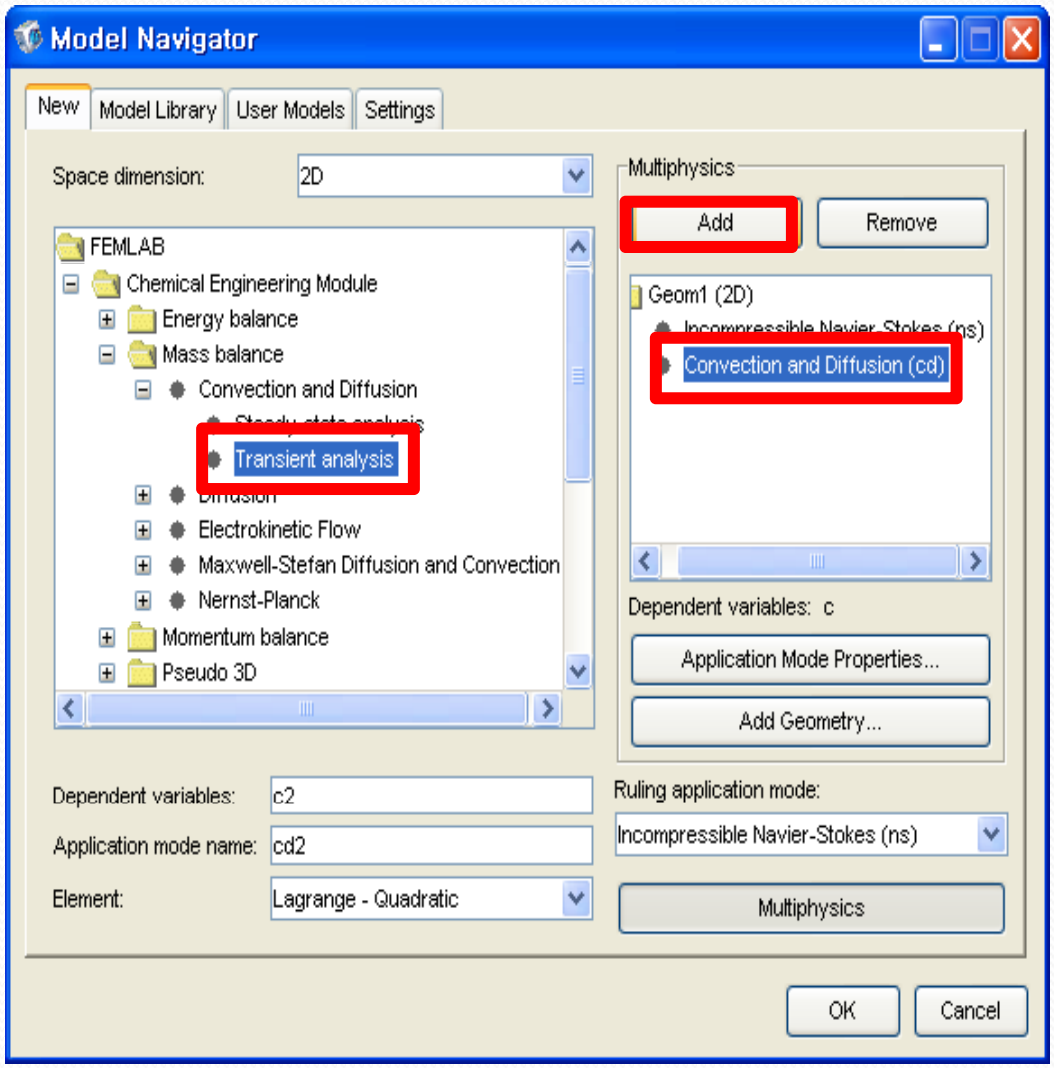
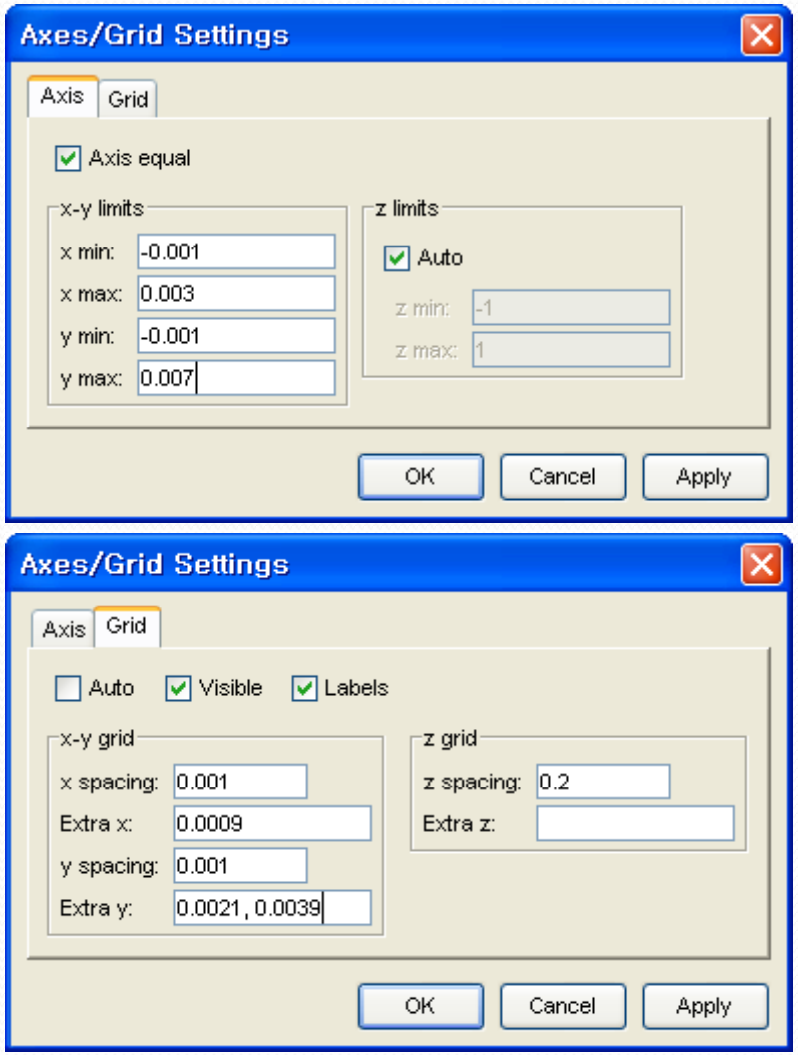
Catalyst pellet modelling by FEMLEB

Model Selection



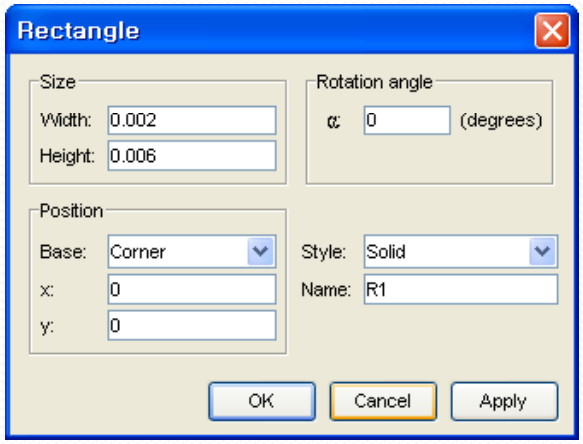
1. FEMLEB 실행
2. Multiphysics 클릭
3. Fluid Dynamics에서 Incompressible Navier-Stokes 선택 후 Add
4. Chemical Engineering Module 에서 Mass balance → Transient analysis 선택 후 Add

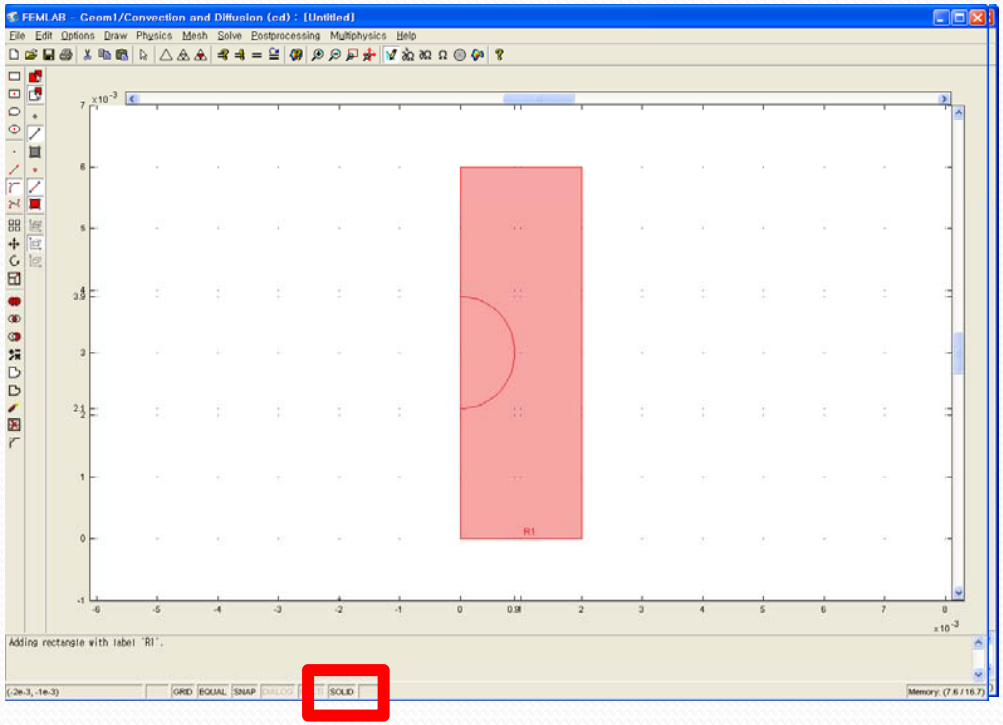
Axis



1. Option Menu – Axis/Grid setting
2. 주어진 Axis/Grid 값 대입
3. OK클릭

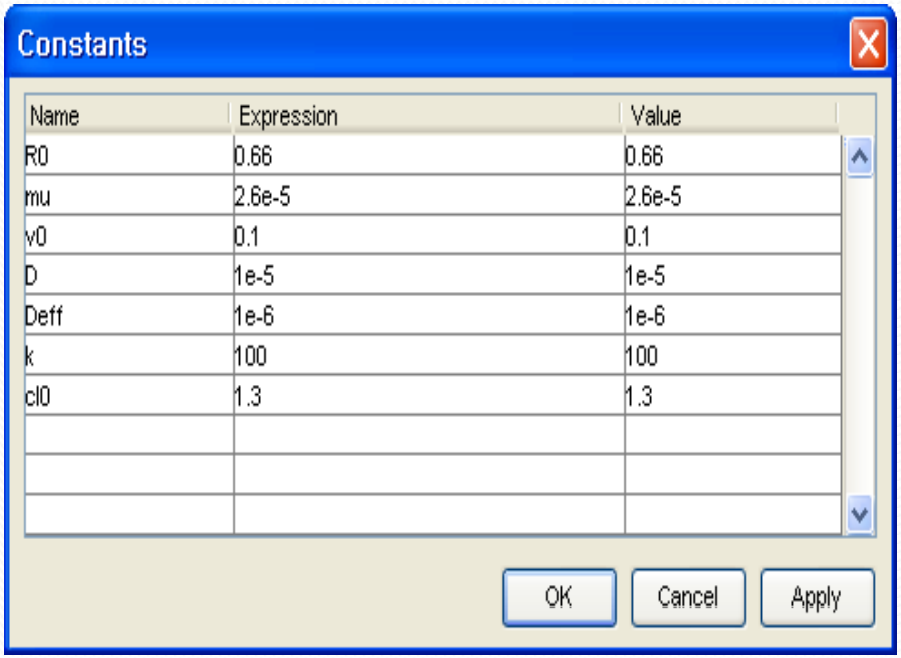
Drawing

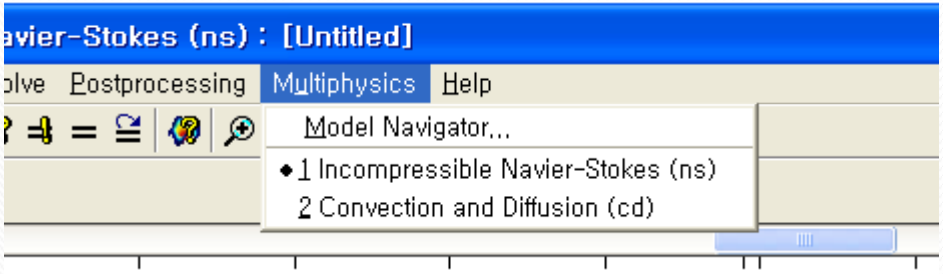




1. Draw Menu – Specific object – Rectangle 선택
2. 너비와 높이 지정 후 OK
3. Status Bar 의 Solid 더블 클릭 해서 선택 해제
4. Draw Menu – Draw Objects – 2nd degree Bezier curve 로 반원 그림

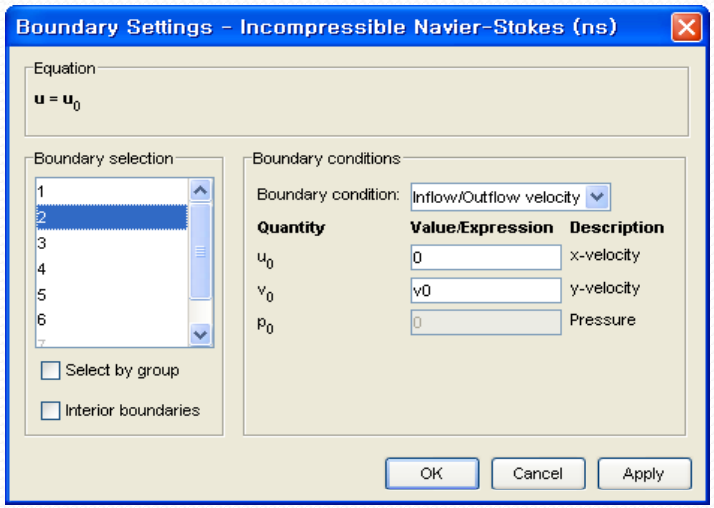
Constants

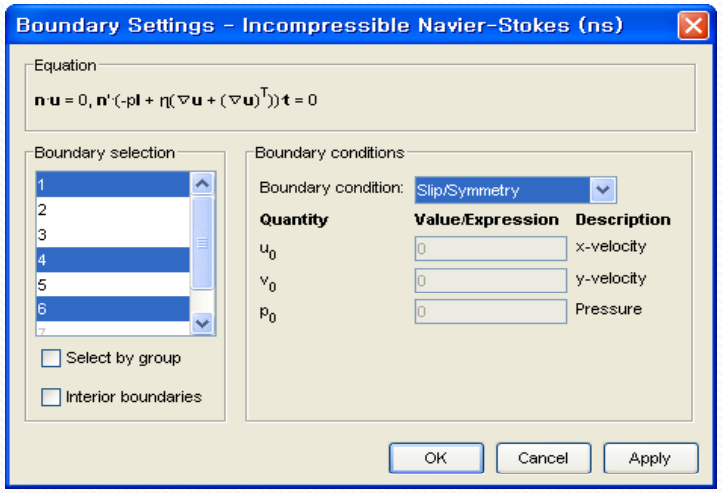


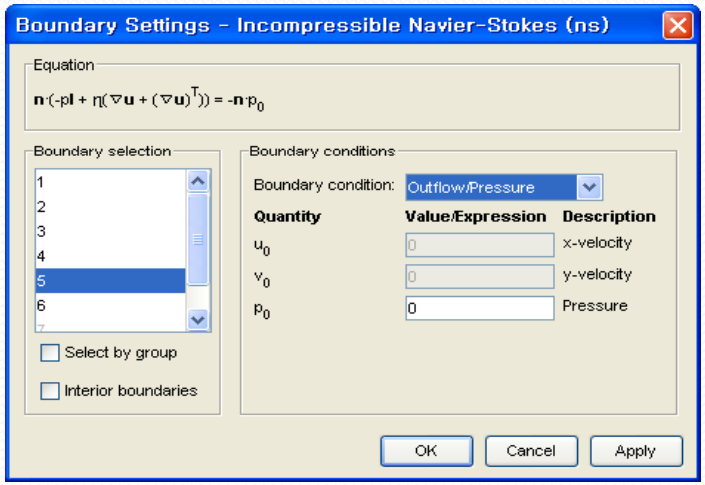


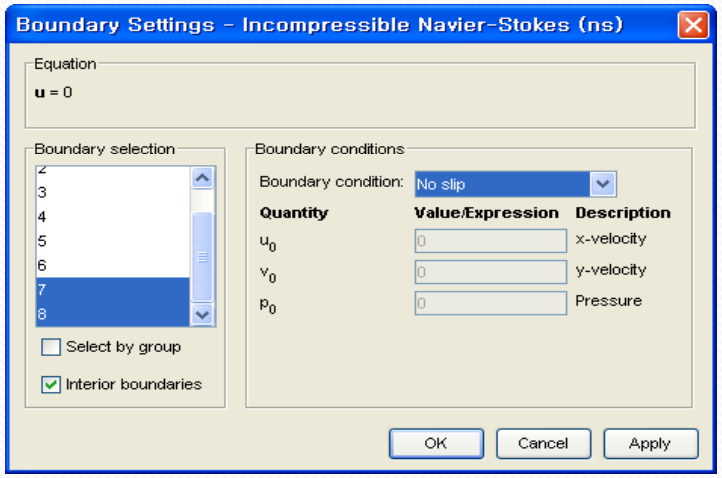
1. Options Menu – Constants
2. 지정된 상수 값 Name 과 Expression 입력
3. Multiphysics Menu – NS 선택

NS Eqn Boundary setting



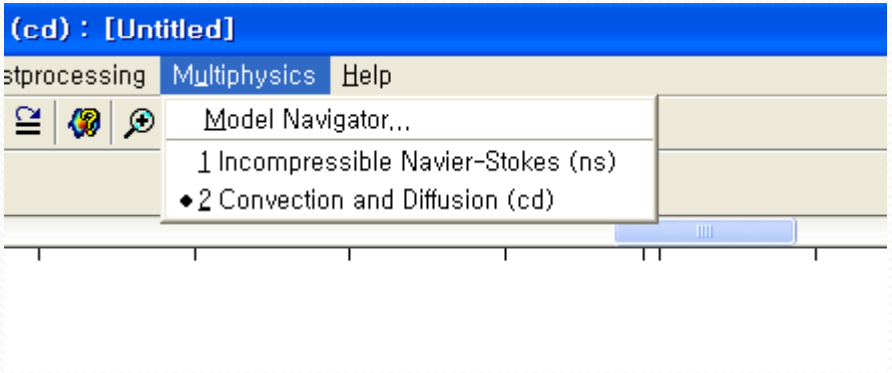


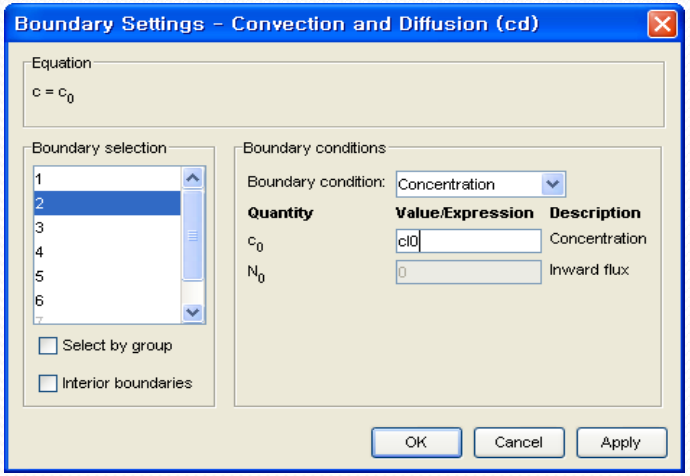


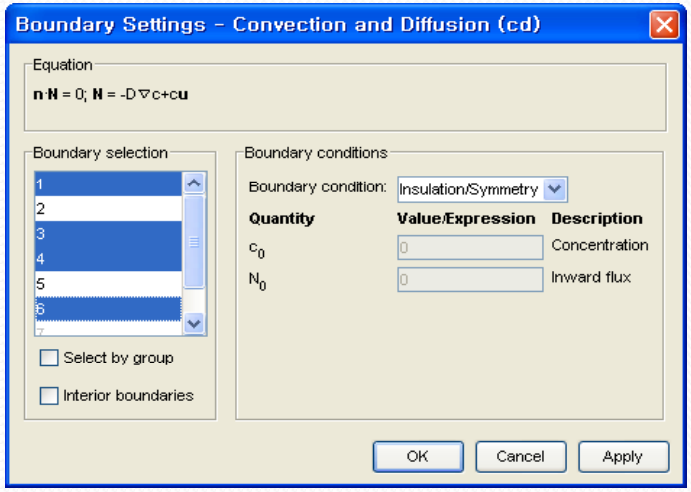


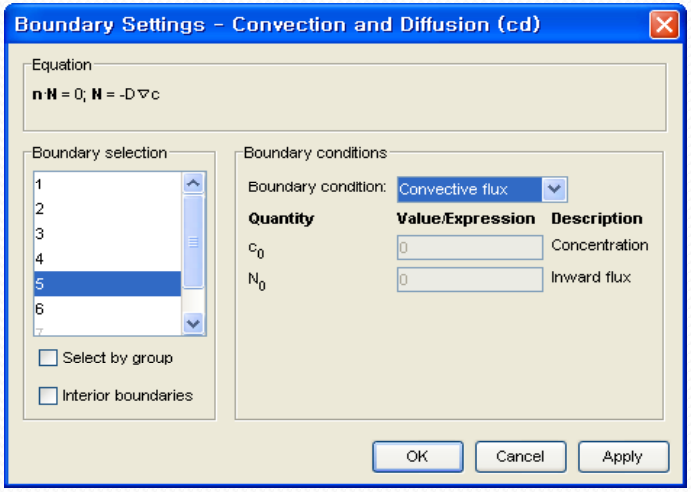
1. Physics Menu – Boundary Settings 선택
2. 각 Boundary 값 지정

CD Eqn Boundary setting



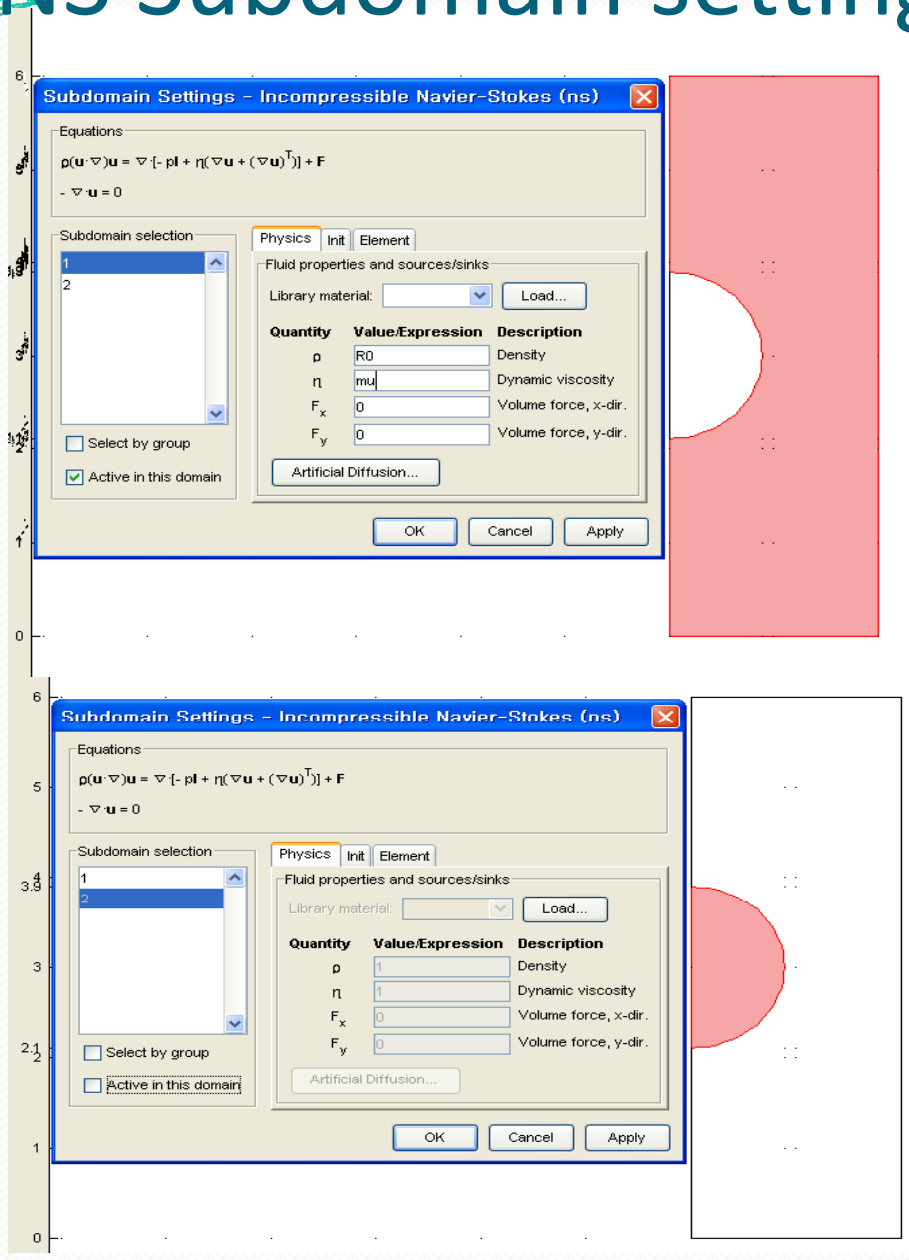






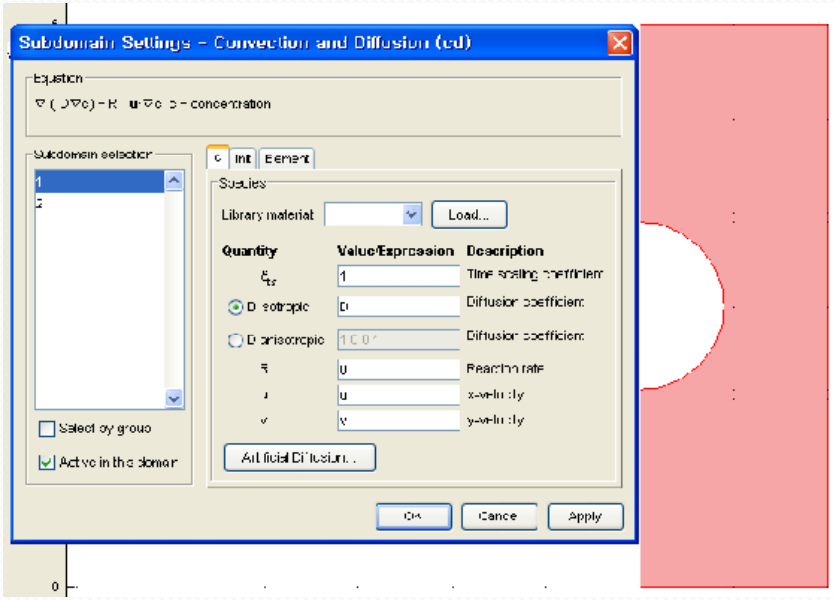
1. Multiphysics Menu- CD 선택
2. Physics Menu – Boundary Settings 선택 후, 각 Boundary 값 지정

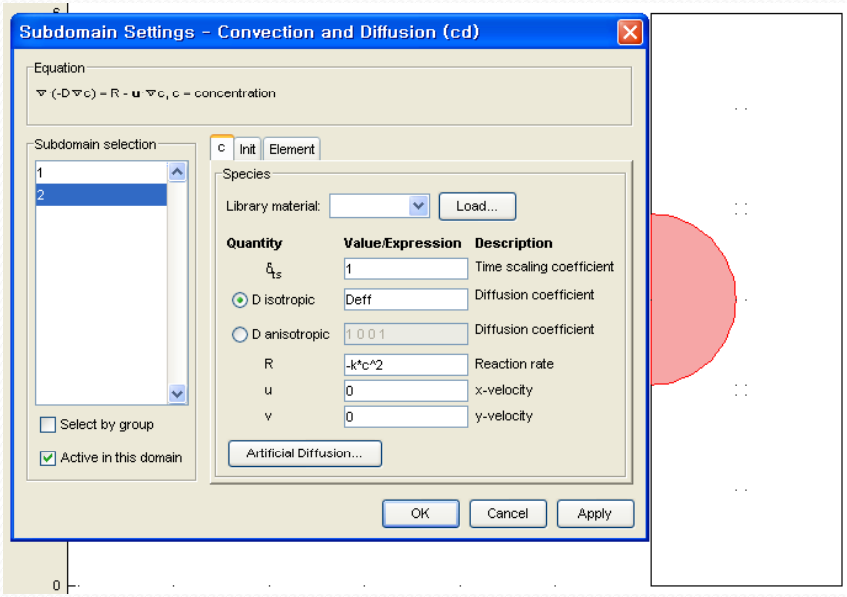
NS Subdomain setting



1. Multiphysics Menu – NS 선택
2. Physics Menu – Selection Mode – Subdomain Settings 선택
3. 각 Subdomain에 수치 대입

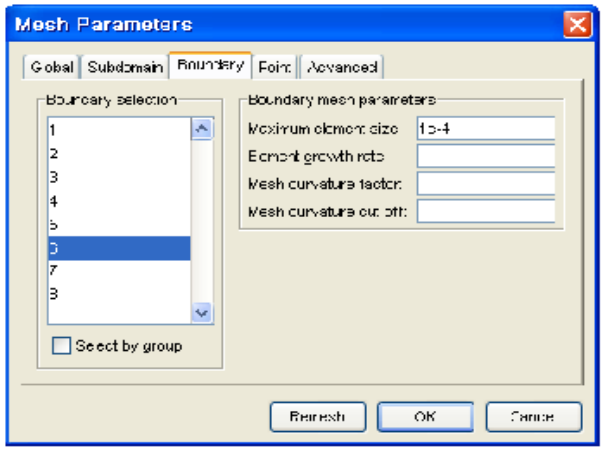
CD Subdomain Settings

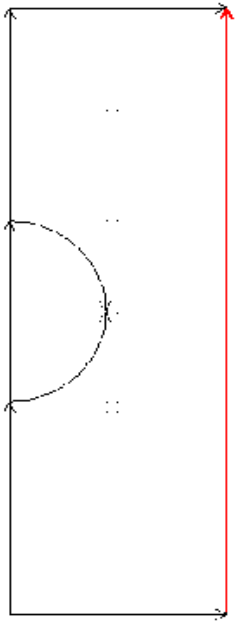


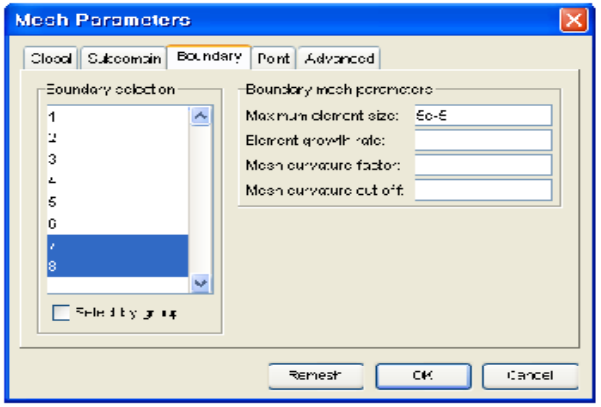


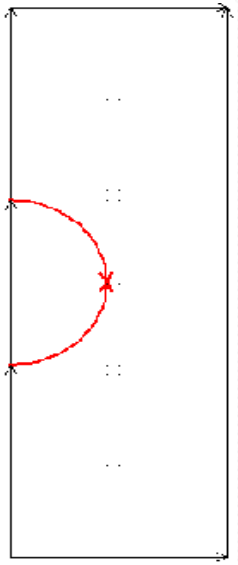
1. Multiphysics Menu – CD 선택
2. Physics Menu – Selection Mode – Subdomain Settings 선택
3. 각 Subdomain Settings 에 수치 대입

Meshing



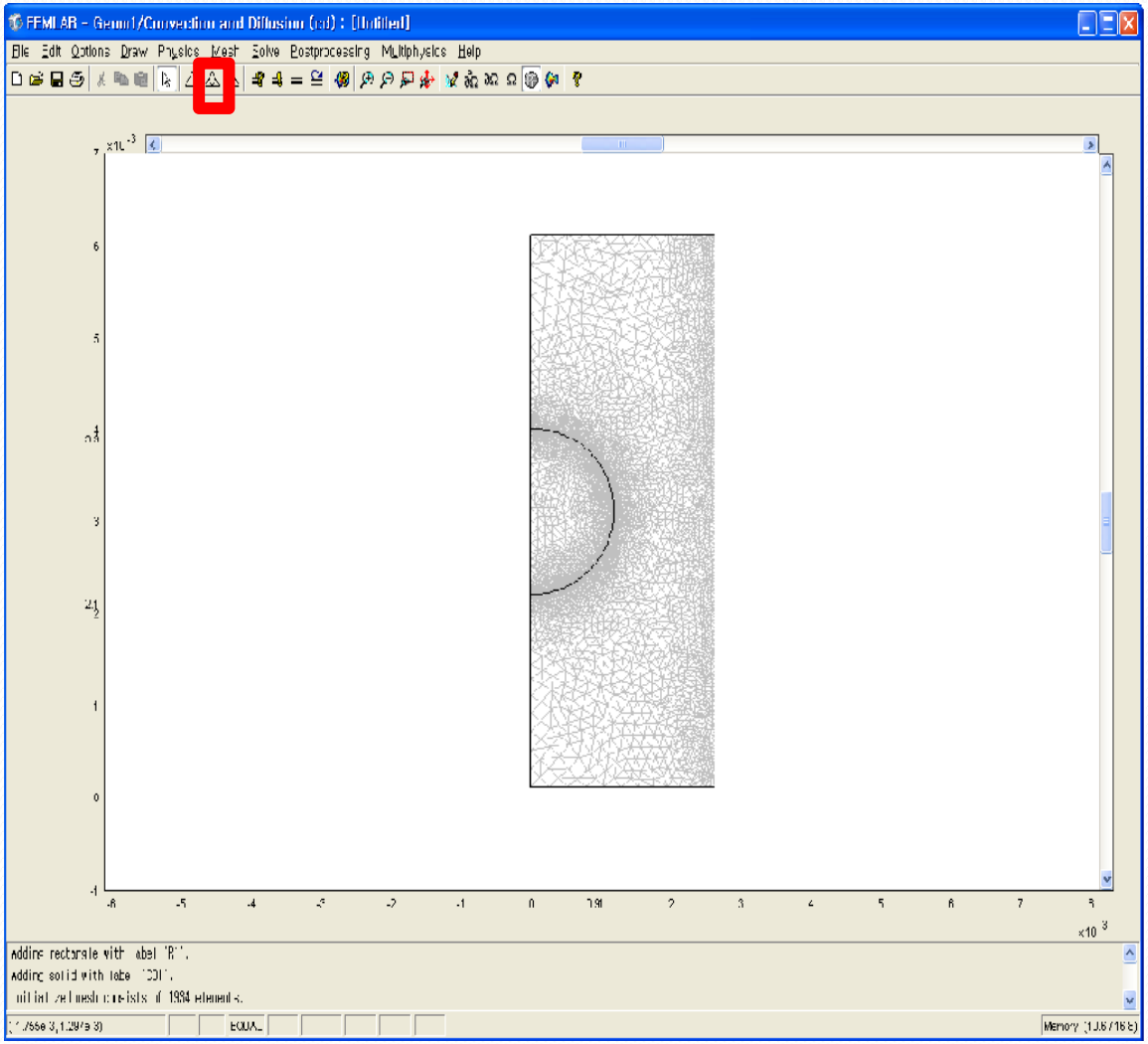






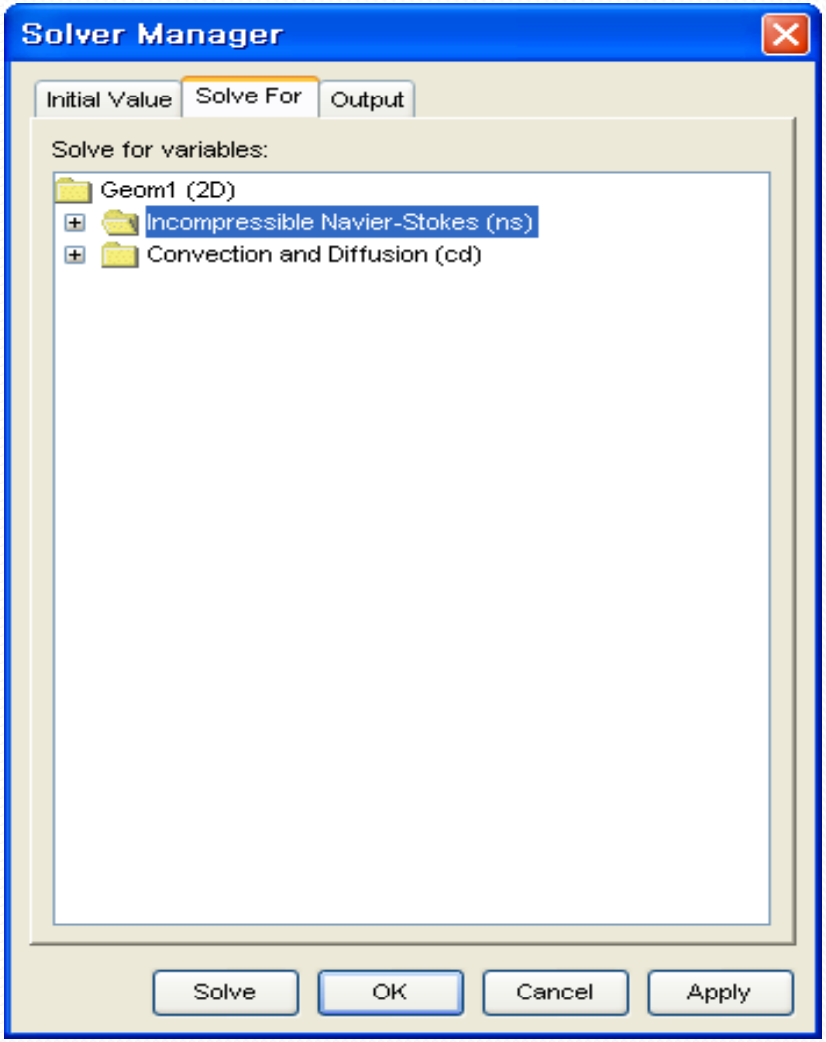
1. Mesh Menu – Mesh Parameter 선택
2. Boundary 최대값 지정

Refined mesh



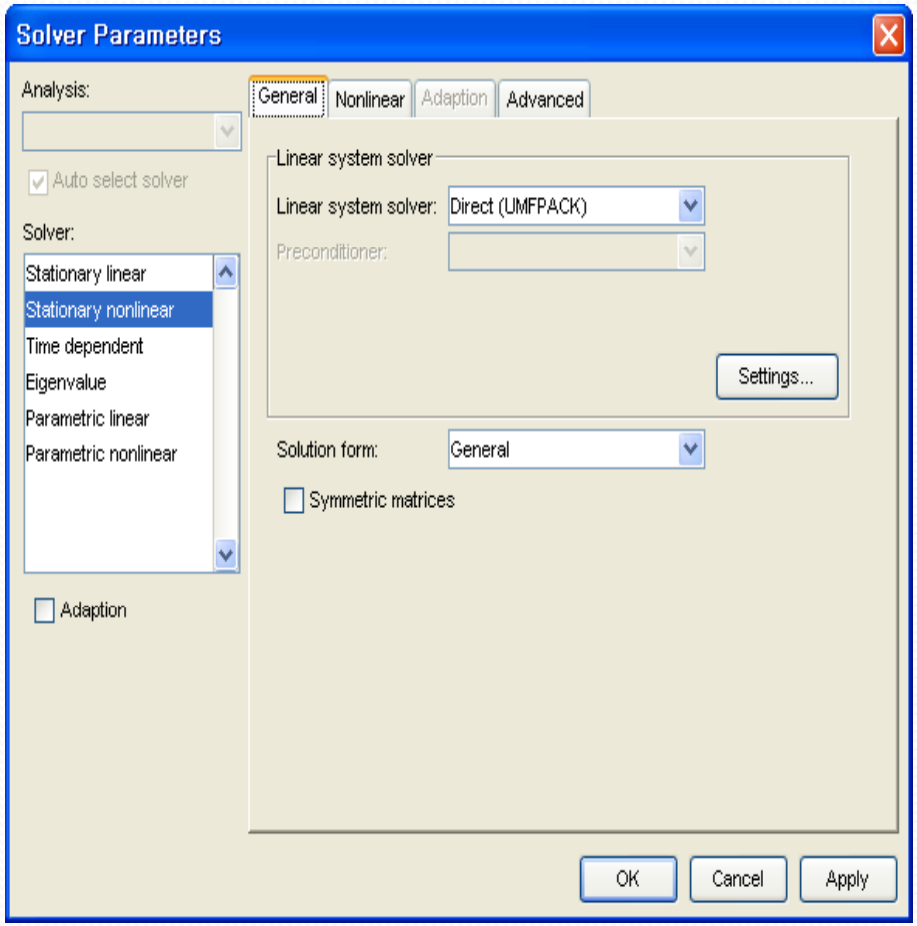
1. 다음과 같은 그래프 얻어짐
2. Refine 버튼 누르면 좀 더 조밀한 그래프 얻을 수 있음

Solve



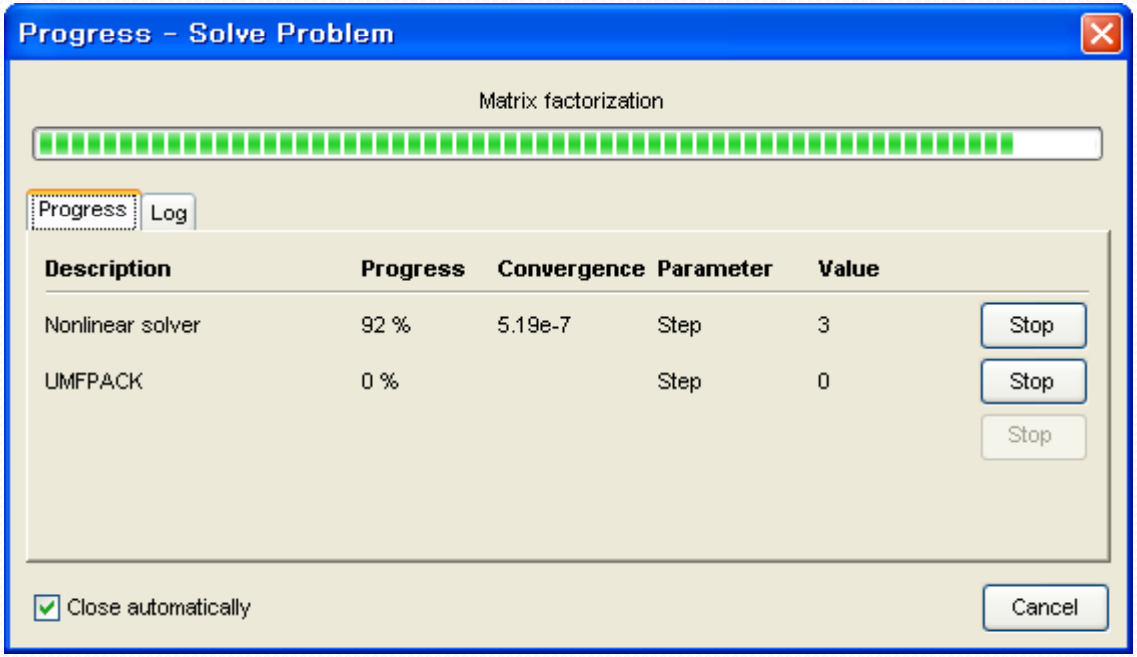
1. Solve Menu – Solver Manager 선택
2. Solve For 탭에서 CD 선택해제

Solve



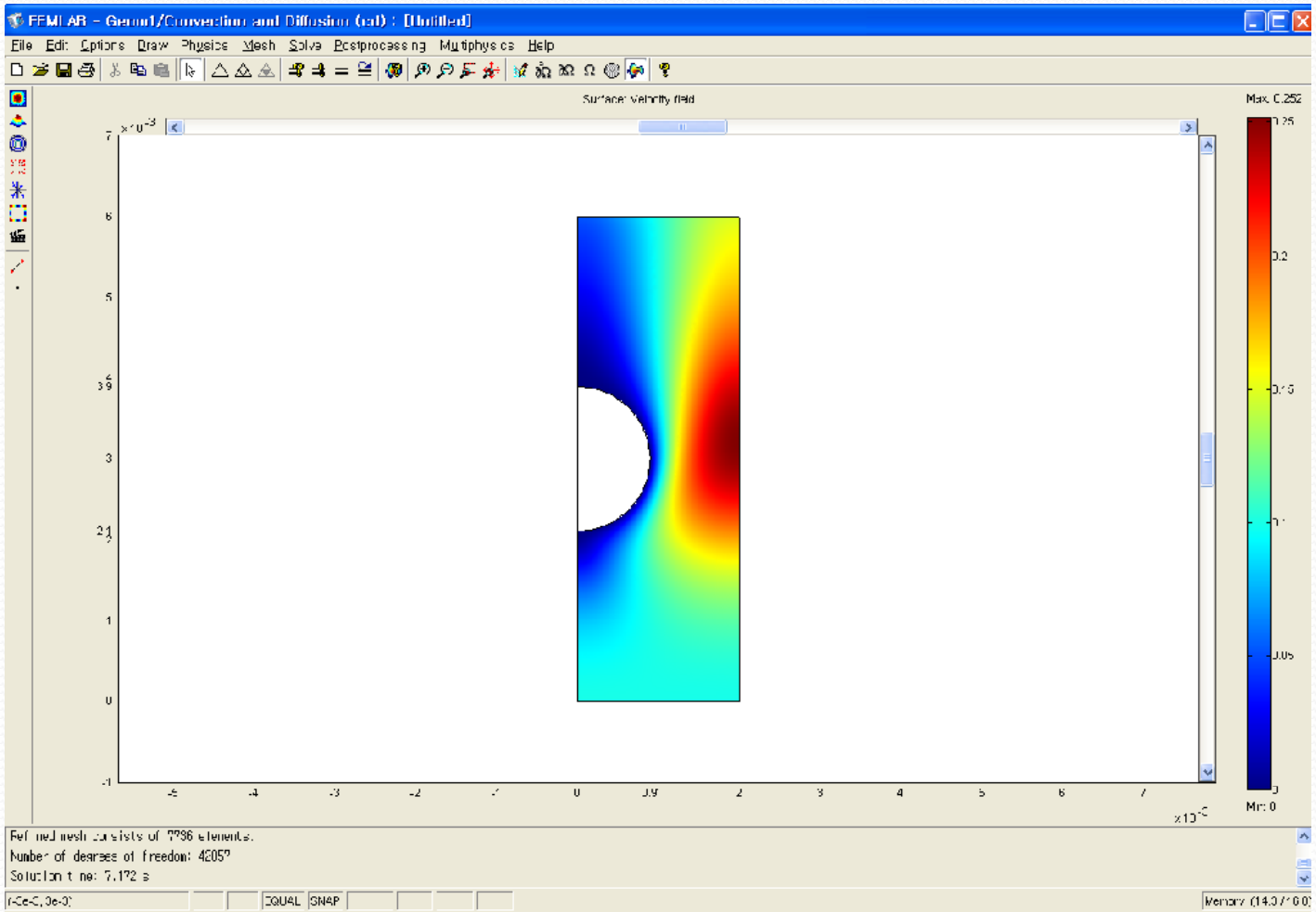
1. Solve Menu – Solver Parameter 선택
2. General탭에서 Staionary nonlinear 선택
3. OK 클릭

Solve



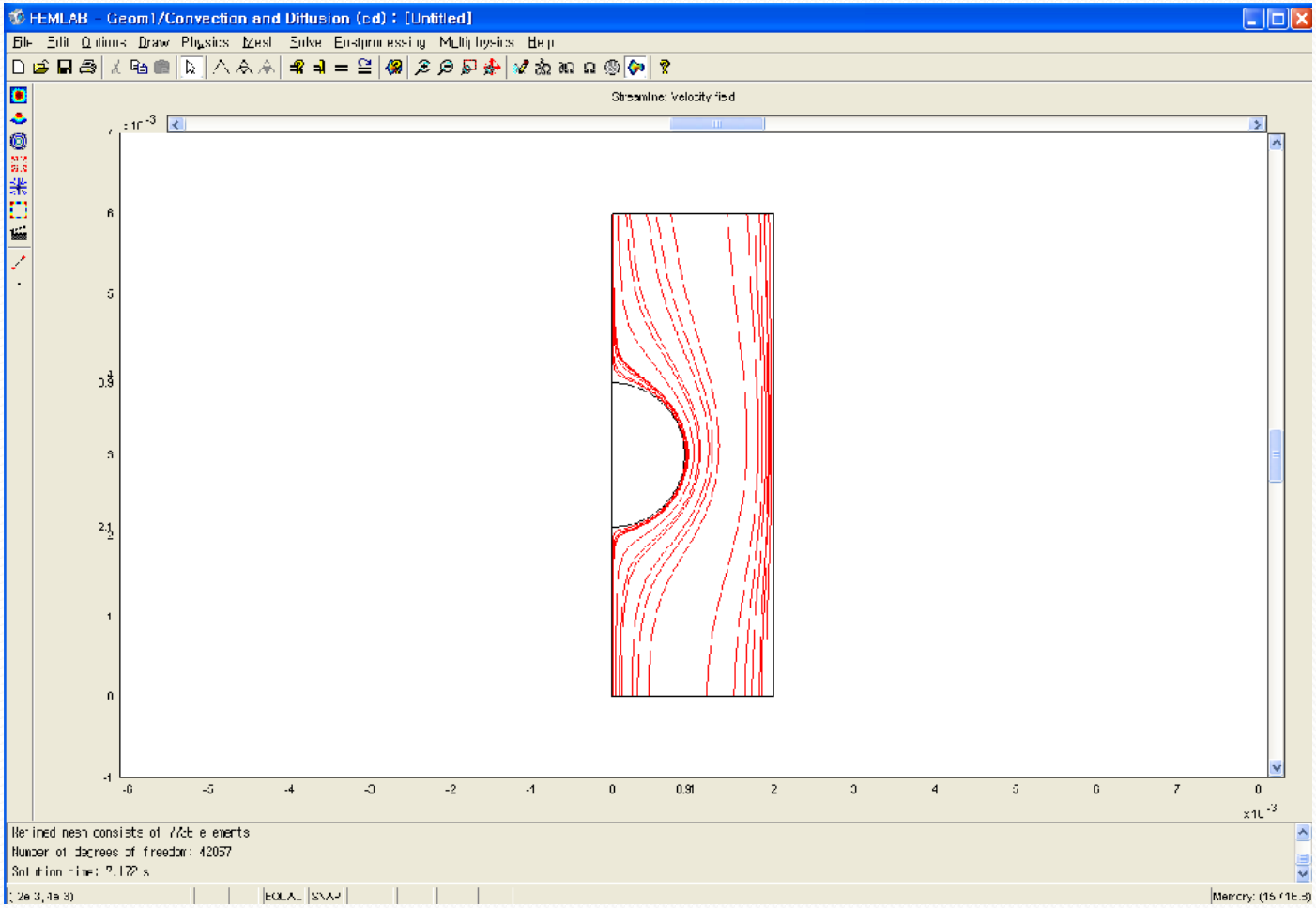
1. Solve Menu – Solve Problem 클릭
2. 주어진 조건에서의 값이 계산 됨

Result



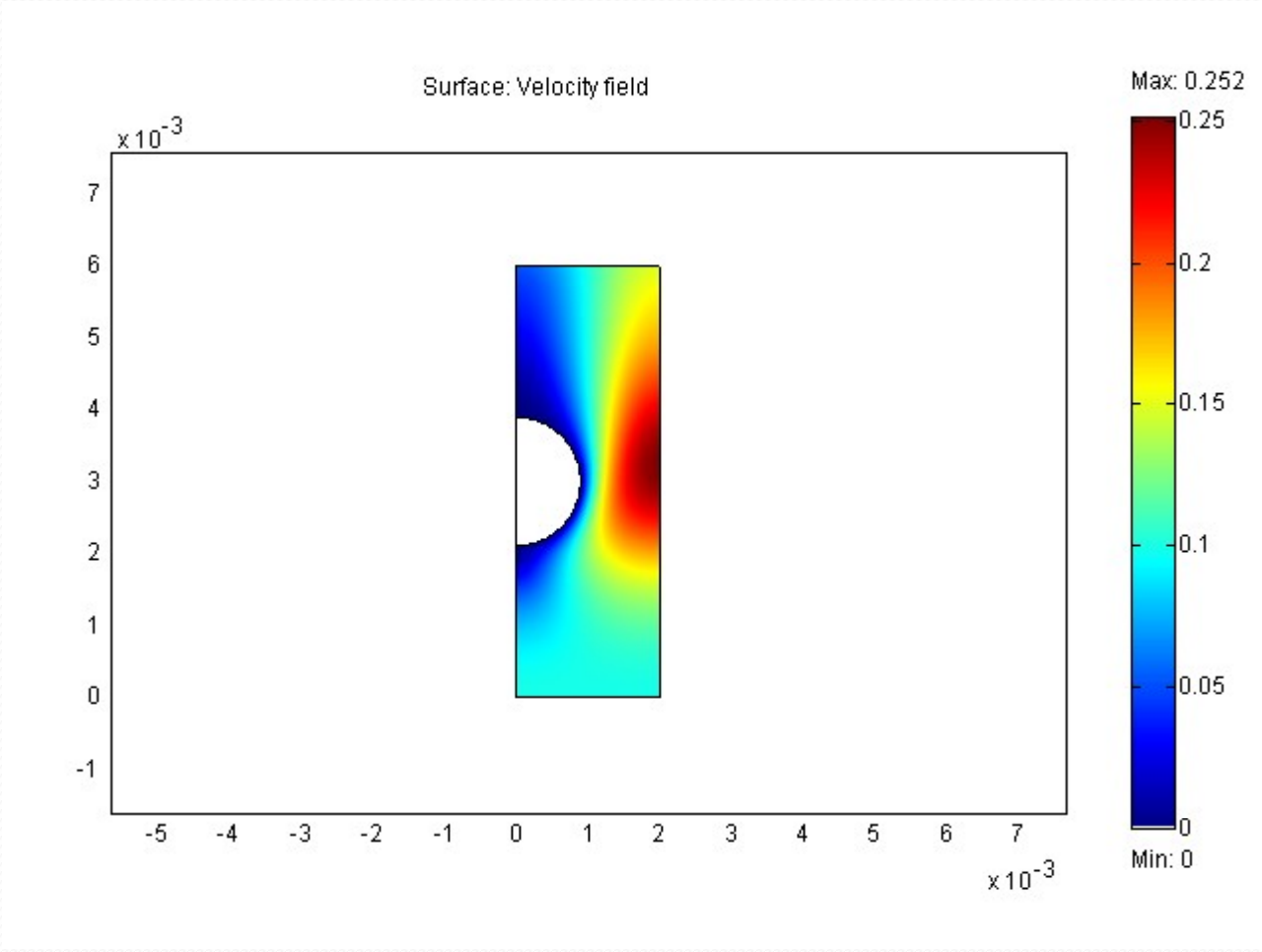
<Surface : Velocity Field>

Result

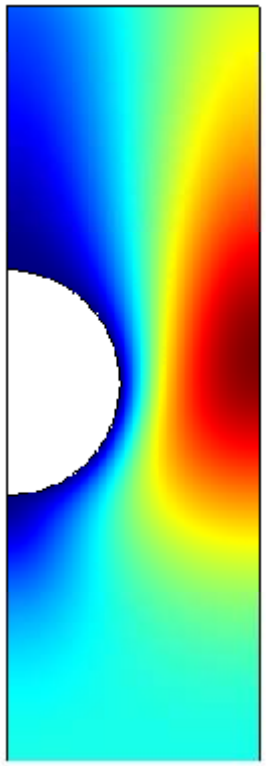


<Streamline : Velocity Field>

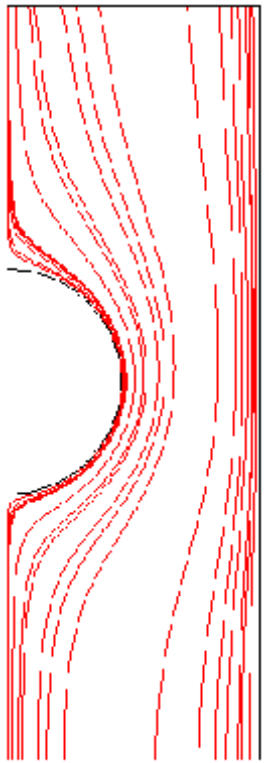
Result


Surface: Velocity field
x 10^-3
7
6
5
4
3
2
1
0
-1
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
x 10^-3
Max: 0.252
0.25
0.2
0.15
0.1
0.05
0
Min: 0

Discussion



Surface plot



Streamline

흐르는 유체 속의 다공성 촉매에 의해서 유체에 속도구배가 생기게 된다. **Pellet**이 있는 부분은 속도가 느려지고 표면 부분은 상대적으로 속도가 빨라지는데 이것은 **Surface plot**에서 파란색으로 부터 붉은색으로 나타난다.

다음으로 이것을 **Streamline**으로도 나타낼 수 있다.