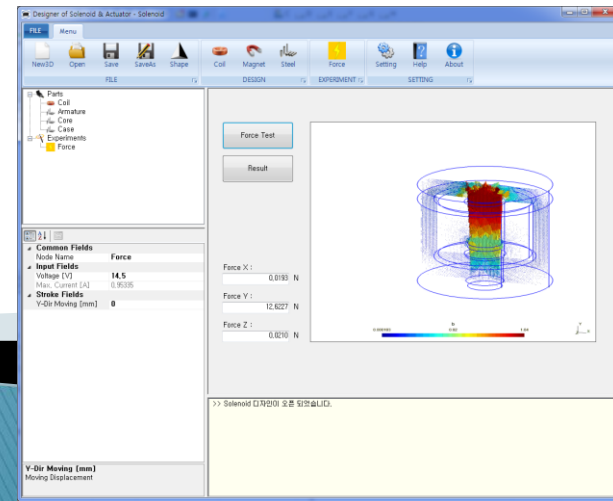


# DoSA-Open\_3D 사용 메뉴얼

## Example of Linear Vibrator

2020-12-02

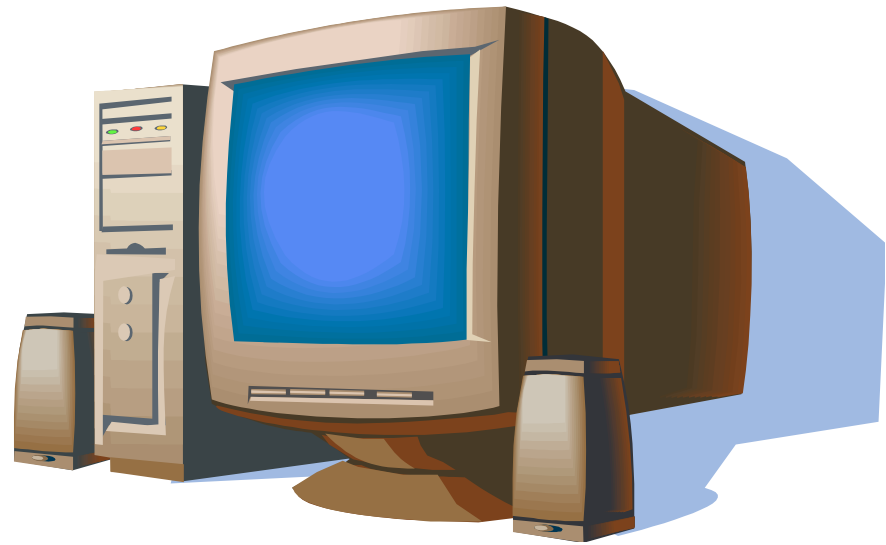
GiTae Kweon (zgitae@gmail.com)



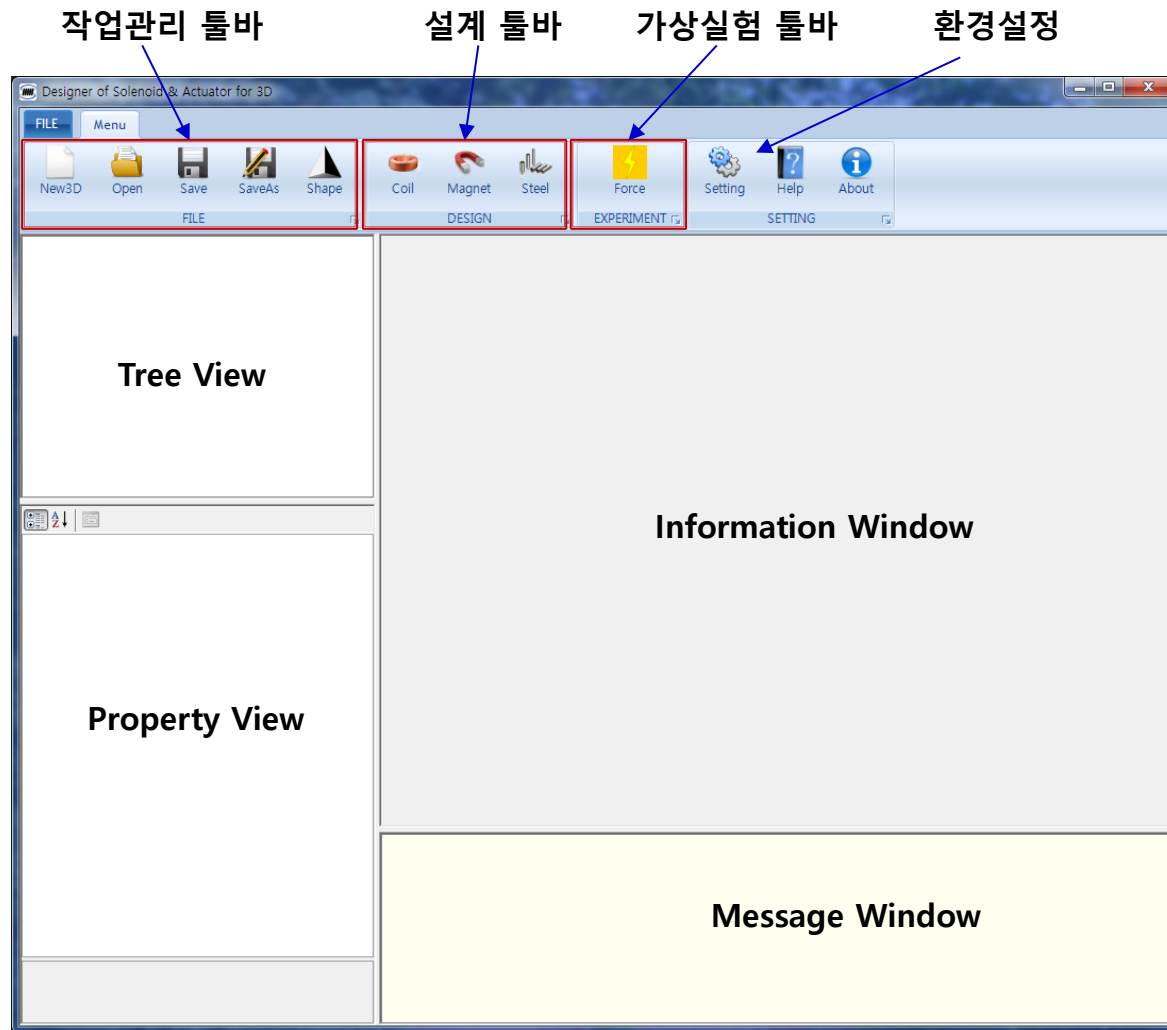
# DoSA 구성

# PC 요구사항

- CPU : 4 Core 이상
- RAM : 16GB 이상



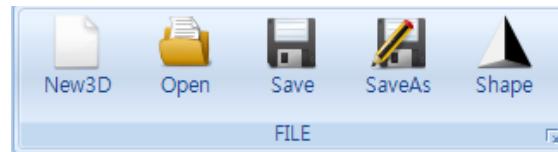
# 프로그램 구성



# Toolbar

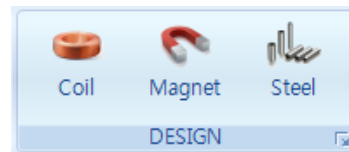
## 1. 작업관리

- ✓ New : 신규작업 생성
- ✓ Open : 이전작업 열기
- ✓ Save : 작업 저장
- ✓ SaveAs : 다른 이름으로 저장
- ✓ Shape : 3D 형상 확인



## 2. 설계

- ✓ Coil : 권선 추가 및 사양 설계
- ✓ Magnet : 영구자석 추가 및 사양 설정
- ✓ Steel : 연자성체 추가 및 사양 설정



## 3. 가상실험

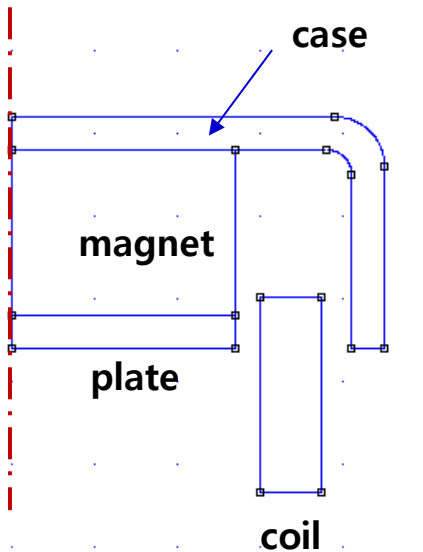
- ✓ Force : 구동부 자기력 예측



# 해석 모델

# 해석모델 설명

## 1. 형상 모델



## 2. 제품 사양

### 가. 코일권선

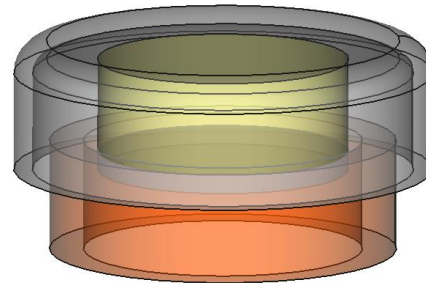
- Coil Turns : 126 turns
- Coil Resistance : 15.75 Ohm

### 나. 영구자석

- Material : NdFeB 40
- 착자방향 : 90 (UP)

### 다. 전원

- Voltage : 2.5V



( 작업 예제파일 : DoSA-Open\_3D 설치 디렉토리 > Samples > LV )

# Design 생성

1. Toolbar > New 버튼 클릭



2. Design Name : 작업 명칭 입력 ( LV )

3. Shape File (STEP) : LV.step 선택하기 ( 작업 예제파일 : DoSA 설치 디렉토리 > Samples > LV )

## [ 형상모델 주의 사항 ]

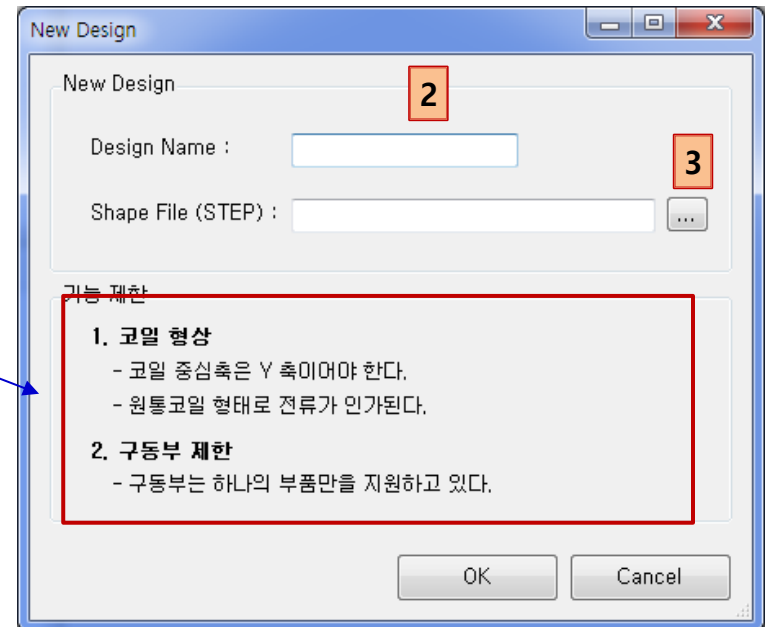
DoSA-Open\_3D 는 아직 아래의 기능제한을 가지고 있음

가. 코일 형상 제한

- 코일 중심 축이 Y 방향이어야 한다.
- 원통코일 형태로 전류가 인가된다.  
( 사각 코일인 경우는 약간의 차이가 발생할 수 있음 )

나. 구동부 형상 제한

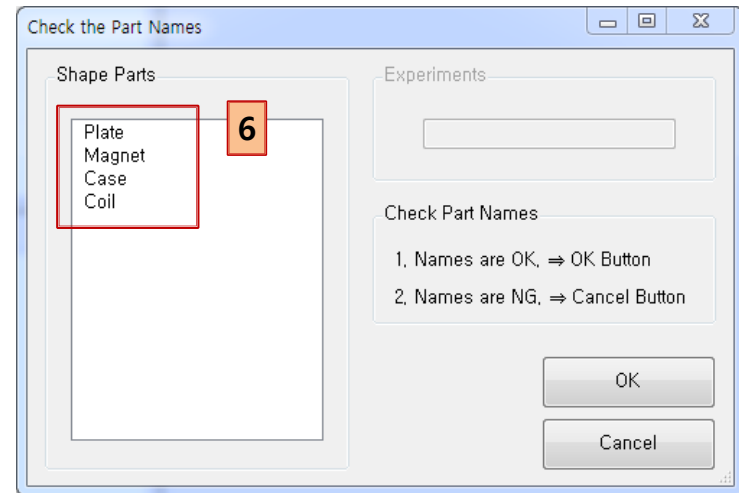
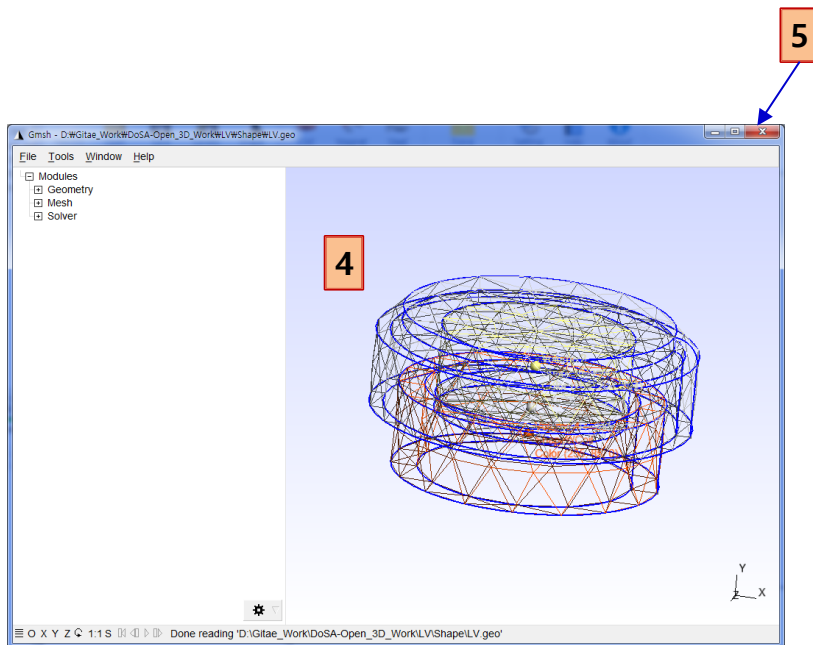
- 구동부는 아직 하나의 부품만을 지원하고 있다.





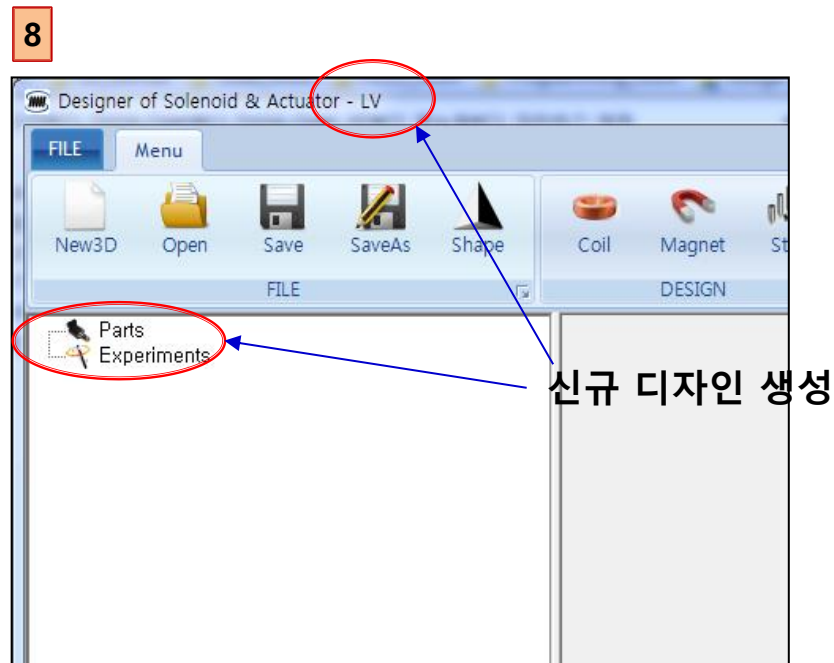
# Design 생성

4. Gmsh 에서 Solenoid 3차원 형상을 확인한다.
5. Gmsh 를 종료한다.
6. Part Name 을 확인 한다.
7. 형상과 Part Name 에 문제가 없다면 OK 를 클릭한다.



# Design 생성

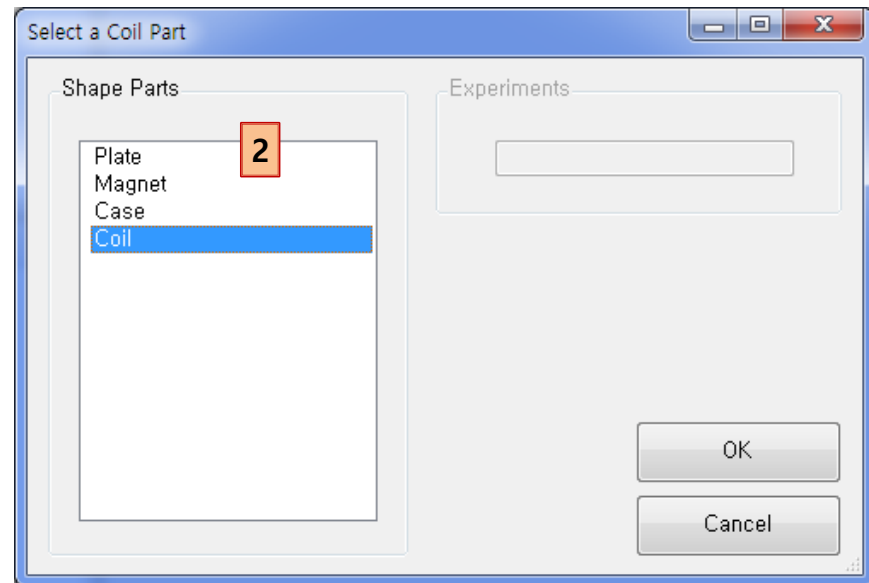
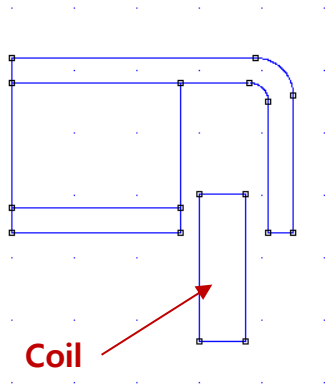
8. Design 생성을 확인한다.



# Parts Design

# Coil 추가

1. Toolbar > Coil 버튼 클릭
2. List Box 에서 "Coil" 선택
3. OK 버튼 클릭



# Coil 설계

## 1. Coil 기구사양 입력

- ✓ Part Material : Copper 선택
- ✓ Current Direction : IN 선택 (안쪽 방향)
- ✓ Moving Parts : MOVING 선택 (구동 부품)
- ✓ Coil Wire Grade : Bonded\_IEC\_Grade\_1B 선택
- ✓ Inner Diameter : 3 mm
- ✓ Outer Diameter : 3.73 mm
- ✓ Coil Height : 1.18 mm
- ✓ Copper Diameter : 0.045 mm
- ✓ Horizontal Coefficient : 0.95 (Bonded Type)
- ✓ Vertical Coefficient : 1.13 (Bonded Type)
- ✓ Resistance Coefficient : 1.1 (Bonded Type)

## 2. Coil 사양 계산

- ✓ Design Coil 버튼 클릭

2

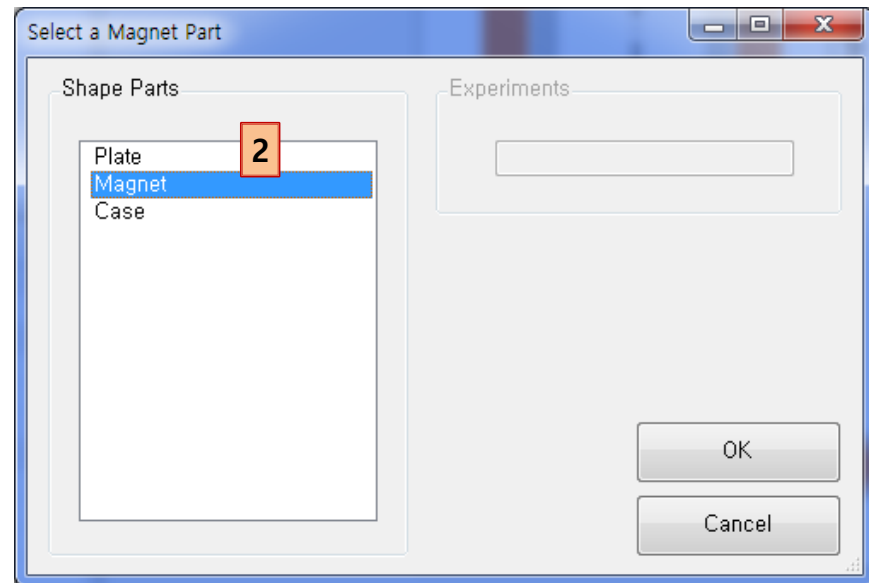
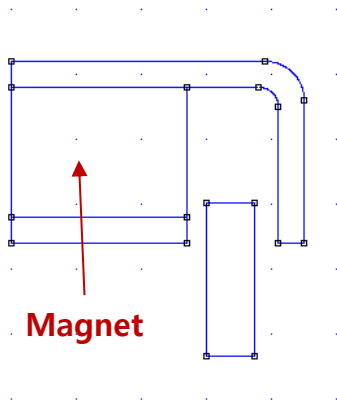
Coil Design

1

<b>Common Fields</b>	
Node Name	Coil
<b>Specification Fields</b>	
Part Material	Copper
Current Direction	IN
Moving Parts	MOVING
<b>Calculated Fields</b>	
Coil Turns	126
Coil Resistance [ $\Omega$ ]	15,74769
Coil Layers	6
Turns of One Layer	21
<b>Design Fields (optional)</b>	
Coil Wire Grade	Bonded_IEC_Grade_1B
Inner Diameter [mm]	3
Outer Diameter [mm]	3.73
Coil Height [mm]	1.18
Copper Diameter [mm]	0.045
Wire Diameter [mm]	0.04953
Coil Temperature [ $^{\circ}\text{C}$ ]	20
Horizontal Coefficient	0.95
Vertical Coefficient	1.13
Resistance Coefficient	1.1

# Magnet 추가

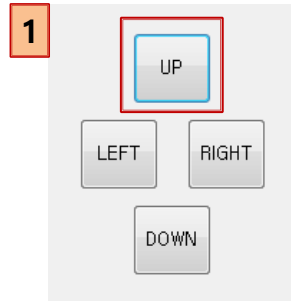
1. Toolbar > Magnet 버튼 클릭
2. List Box 에서 "Magnet" 선택
3. OK 버튼 클릭



# Magnet 설정

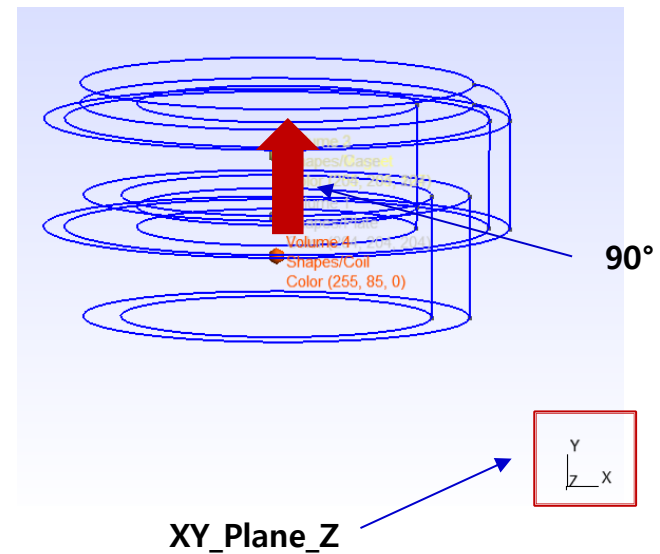
## 1. Magnet 속성 설정

- ✓ Part Material : NdFeB\_40 선택
- ✓ Hc, Br 은 자동 설정됨
- ✓ Moving Parts : FIXED 선택 (고정 부품)
- ✓ Magnet Plane : XY\_Plane\_Z
- ✓ Magnet Angle : 90 or Up 버튼 클릭



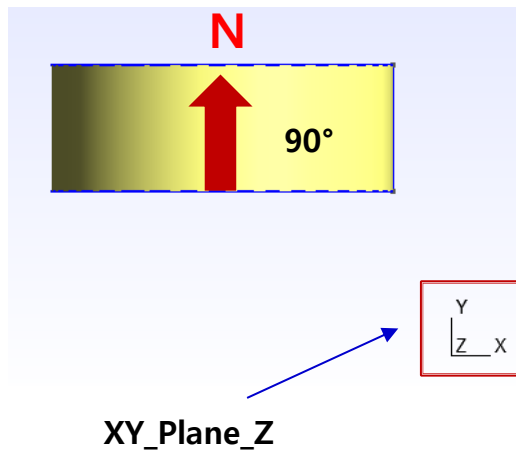
1

Common Fields	
Node Name	Magnet
Specification Fields	
Part Material	NdFeB_40
Hc	969969
Br	1.26497
Moving Parts	FIXED
Magnetization Fields	
Magnet Plane	XY_Plane_Z
Magnet Angle	90

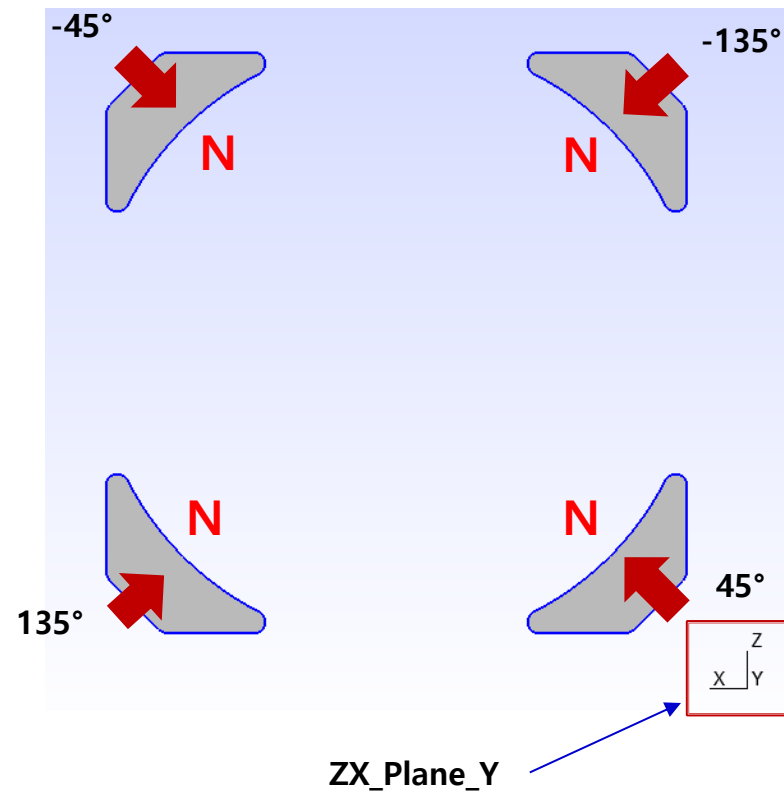


# [참고] Magnet 착자설정

- ✓ Magnet Plane : XY\_Plane\_Z
- ✓ Magnet Angle : 90°



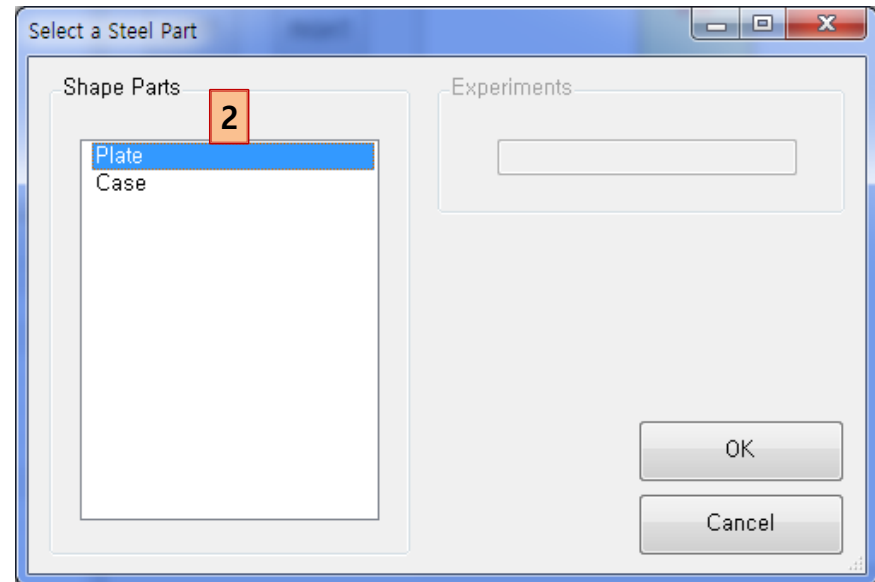
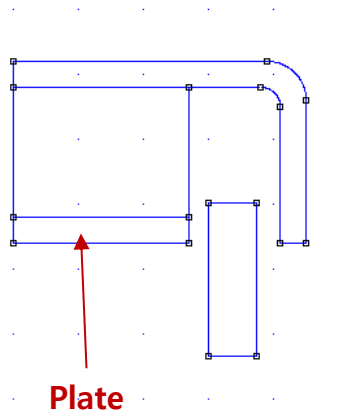
- ✓ Magnet Plane : ZX\_Plane\_Y
- ✓ Magnet Angle : 45° (135°, -45°, -135°)





# Plate 추가

1. Toolbar > Steel 버튼 클릭
2. List Box 에서 "Plate" 선택
3. OK 버튼 클릭

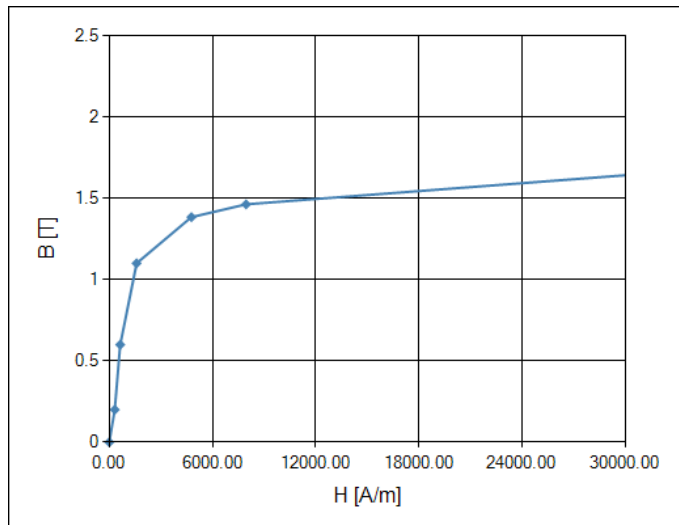


# Plate 설정

## 1. Plate 속성 설정

- ✓ Part Material : SUS\_430 선택
- ✓ Moving Parts : FIXED (고정 부품)

[ BH 곡선 ]

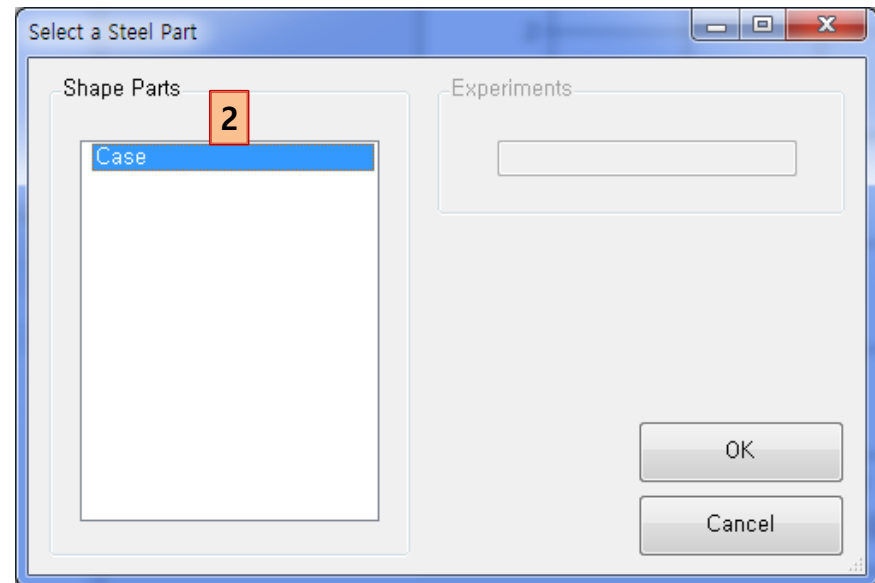
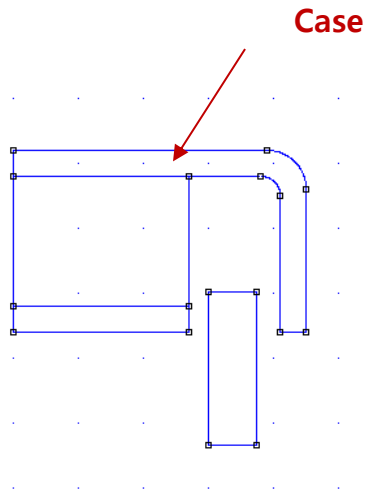


1

Common Fields	
Node Name	Plate
Specification Fields	
Part Material	SUS_430
Moving Parts	FIXED

# Case 추가

1. Toolbar > Steel 버튼 클릭
2. List Box 에서 "Case" 선택
3. OK 버튼 클릭

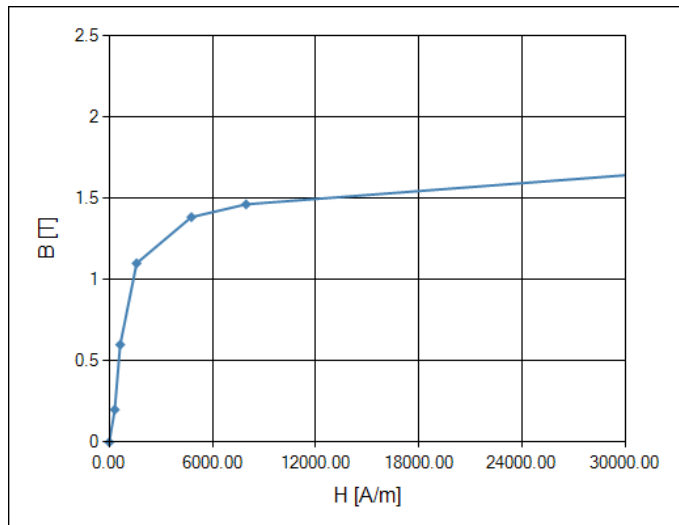


# Case 설정

## 1. Case 속성 설정

- ✓ Part Material : SUS\_430 선택
- ✓ Moving Parts : FIXED (고정 부품)

[ BH 곡선 ]



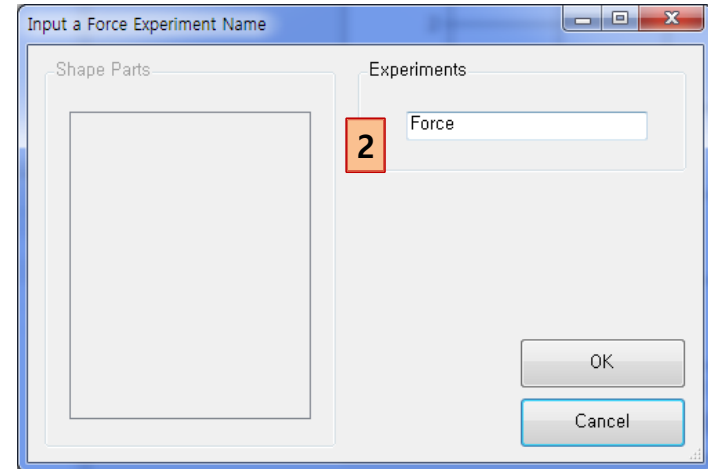
1

Common Fields	
Node Name	Case
Specification Fields	
Part Material	SUS_430
Moving Parts	FIXED

# Virtual Experiments

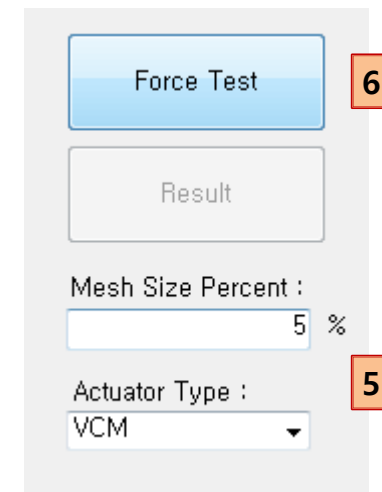
# 자기력 가상실험

1. Toolbar > Force 버튼 클릭
2. Experiment Name 입력 : "force"
3. OK 버튼 클릭
4. 자기력 가상실험 설정
  - ✓ Voltage : 2.5 V
5. 해석조건 설정
  - ✓ Mesh Size Percent : 5 %
  - ✓ Actuator Type : VCM 선택
6. Force Test 버튼 클릭



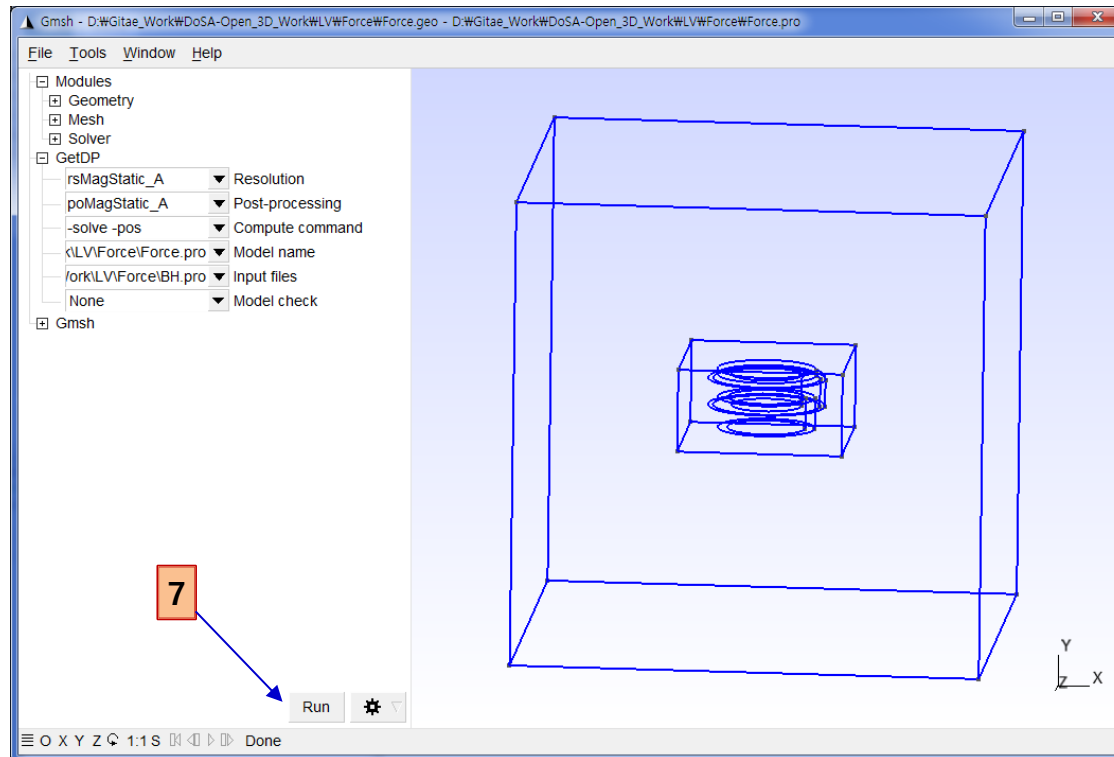
Common Fields	
Node Name	Force
Input Fields	
Voltage [V]	2.5
Max. Current [A]	0.15875
Stroke Fields	
Y-Dir Moving [mm]	0

4



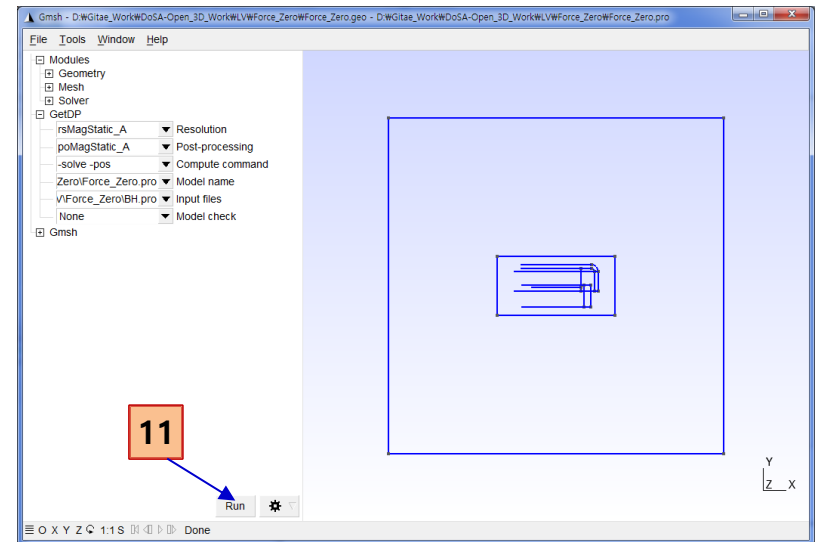
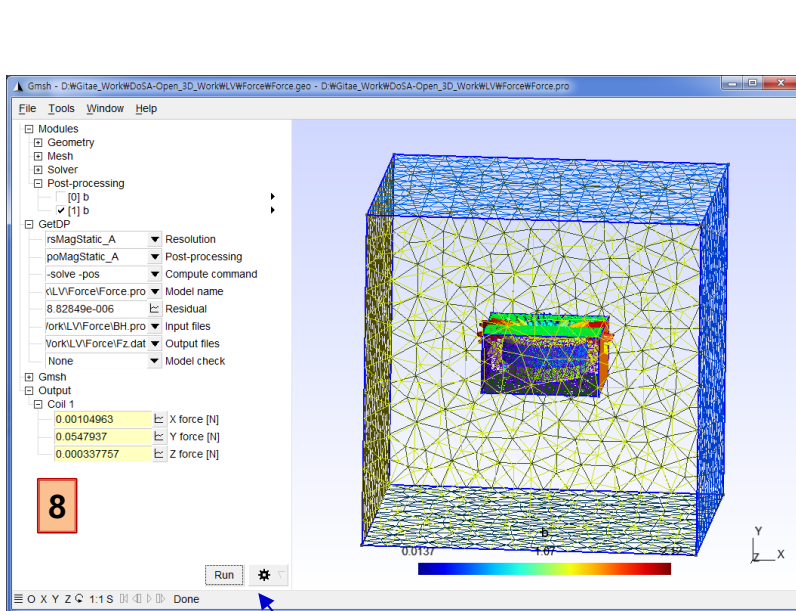
# 자기력 가상실험 실행

7. 형상을 확인 하고 Run 버튼 클릭



# 자기력 가상실험 실행

8. 해석 결과를 확인 함 (해석 시간은 컴퓨터 사양에 따라 다름)
9. 해석 진행 상황을 확인하려면 Gmsh 상태 바를 클릭하세요.
10. **Gmsh** 를 종료함
11. 다시 Run 버튼을 클릭함 ( **VCM 방식 액추에이터는 자기력 정확도를 높이기 위해 두 번 해석을 진행함** )



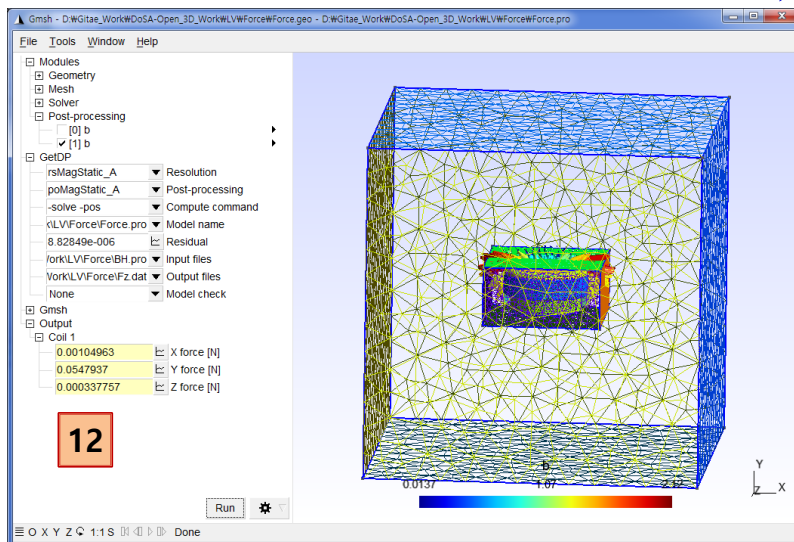


# 자기력 가상실험 결과

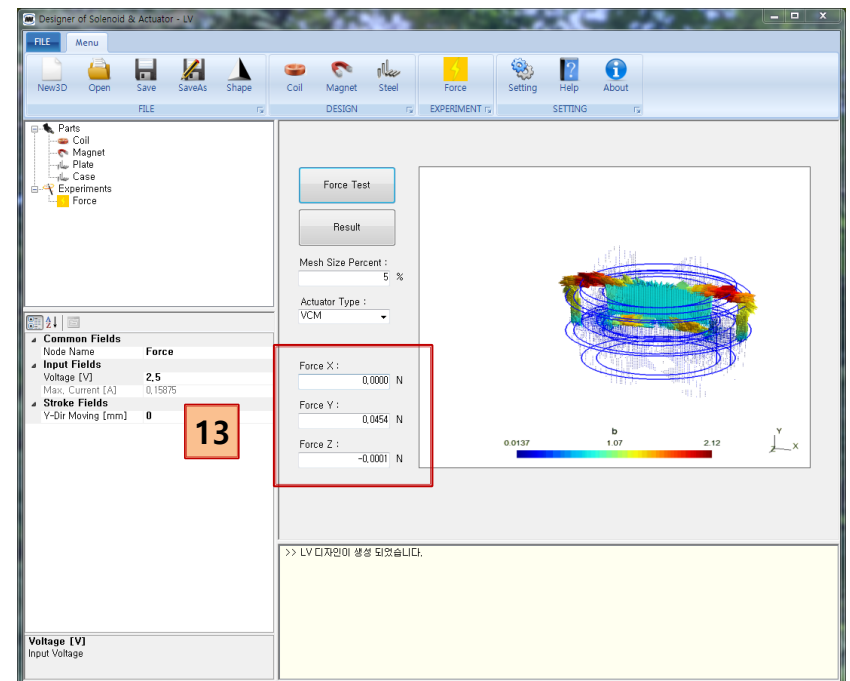
12. 해석 결과를 확인 하고 Gmsh 를 종료함

13. 자기력 확인

12



13



# Thank You

Email : [zgitae@gmail.com](mailto:zgitae@gmail.com)

Homepage : <http://openactuator.org>

