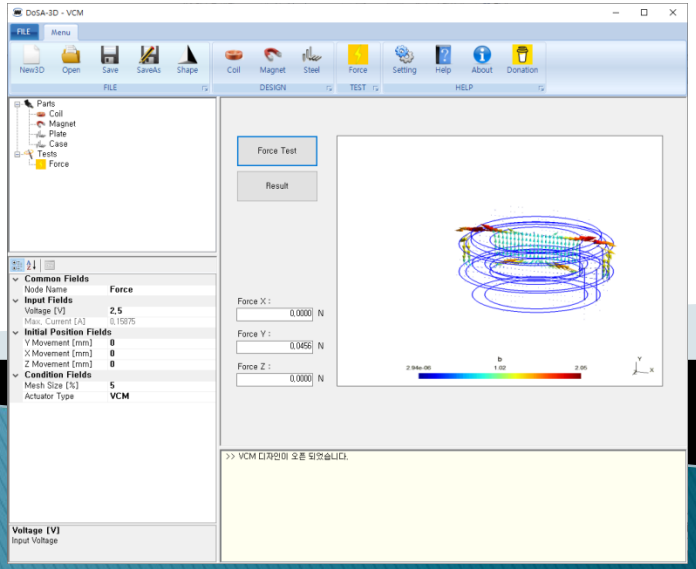
DoSA-3D 사용 메뉴얼

Voice Coil Motor Example

(Speaker, Auto-Focus, Linear Vibrator)



2022-05-28

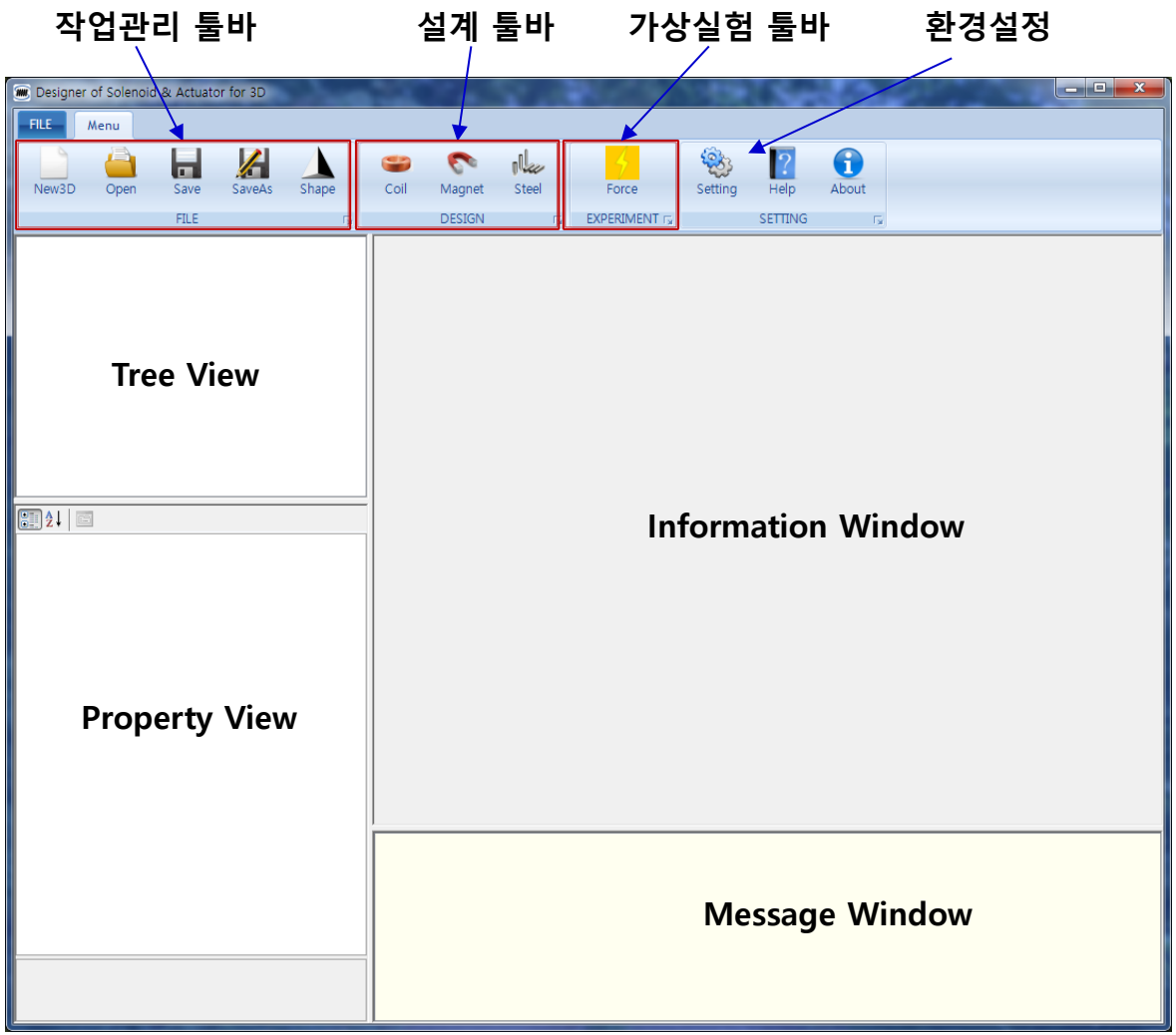
zgitae@gmail.com

DoSA 구성

PC 요구사항

- CPU : 4 Core 이상
- RAM : 16GB 이상

프로그램 구성


작업관리 툴바
설계 툴바
가상실험 툴바
환경설정
Designer of Solenoid & Actuator for 3D
FILE
Menu
New3D
Open
Save
SaveAs
Shape
FILE
Coil
Magnet
Steel
DESIGN
Force
EXPERIMENT
Setting
Help
About
SETTING
Tree View
Property View
Information Window
Message Window

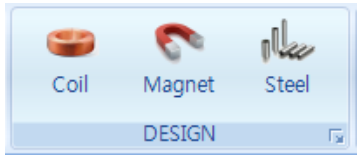
Ribbon Bar

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 : 자기력 예측

작업 흐름

제품 설계

가상 실험

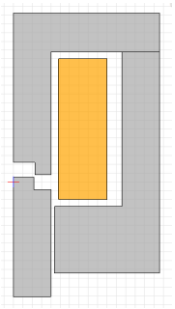
1. 형상설계 → Geometry

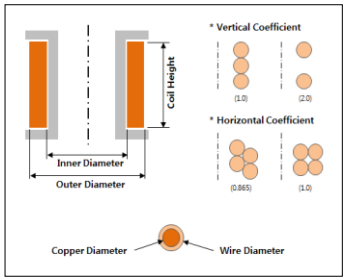
2. 부품설계 → Components

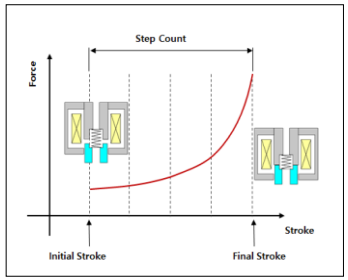
3. 시험조건 → Test Condition

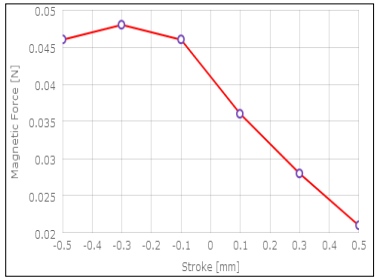
4. 가상실험 (자동실행) → Virtual Test

5. 결과확인 → Results





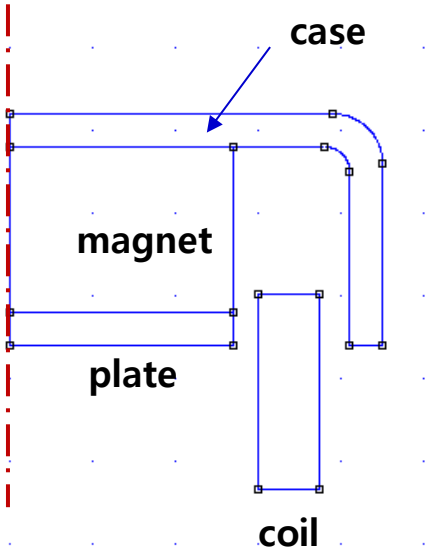


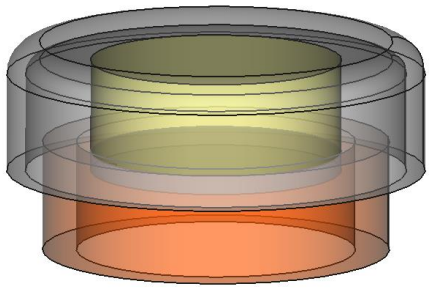


해석 모델

해석모델 설명

1. 형상 모델





VCM.step

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-3D 설치 디렉토리 > Samples > VCM)

Design 생성

1. Toolbar > New 버튼 클릭

2. Design Name : "VCM"

3. Shape File (STEP) : VCM.step 선택 (튜토리얼 문서와 함께 제공됨)

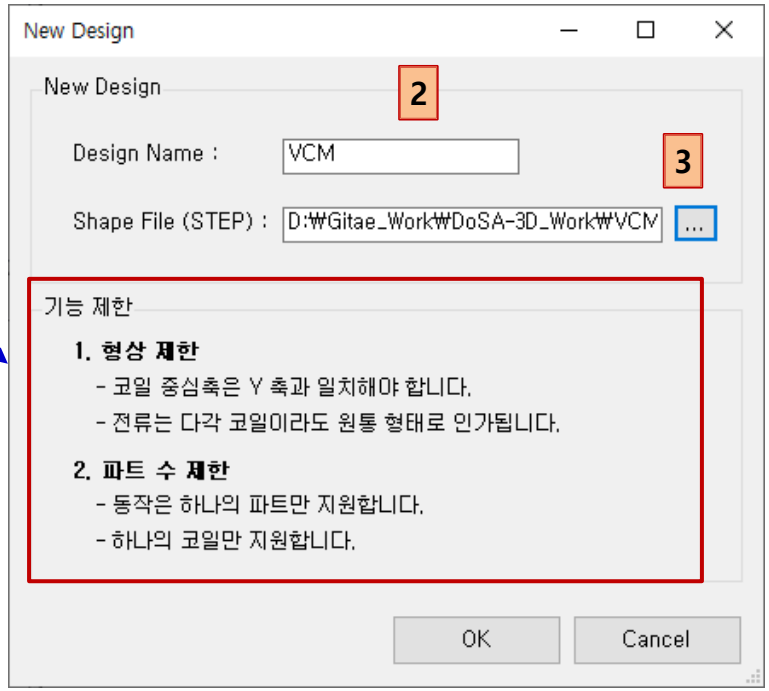
[형상작업 주의사항]

DoSA-3D 는 아직 아래의 기능제한을 가지고 있음

가. 형상 제한
- 코일 중심축은 Y 축과 일치해야 합니다.
- 전류는 다각 코일이라도 원통 형태로 인가됩니다.
  (다각 코일의 경우 약간의 차이가 발생할 수 있음)

나. 파트 수 제한
- 동작은 하나의 파트만 지원합니다.
- 하나의 코일만 지원합니다.

다. 형상작업 가이드
- https://solenoid.or.kr/data/Drawing_Guide_KOR.pdf



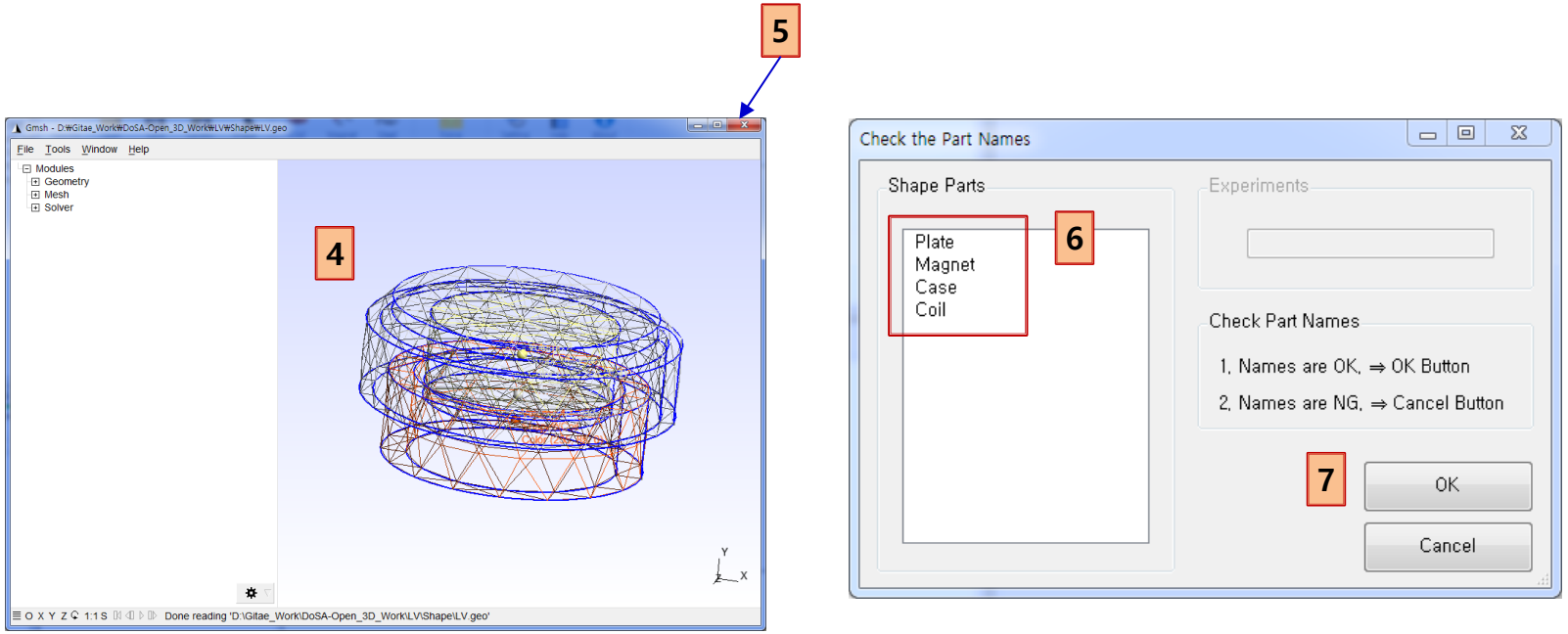
Design 생성

4. Gmsh 에서 Solenoid 3차원 형상을 확인한다.

5. Gmsh 를 종료한다.

6. Part Name 을 확인 한다.

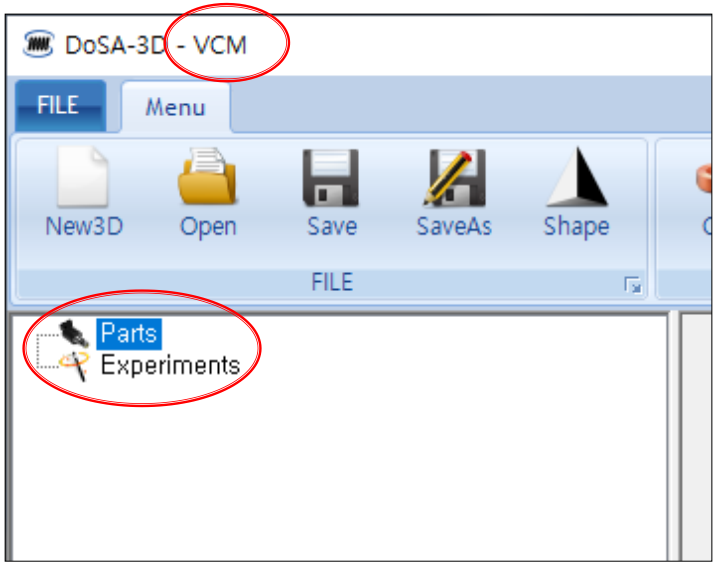
7. 형상과 Part Name 에 문제가 없다면 OK 를 클릭한다.



Design 생성

8. Design 생성을 확인한다.

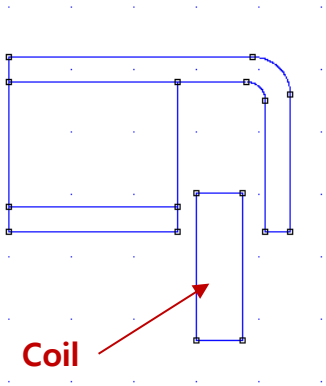
8

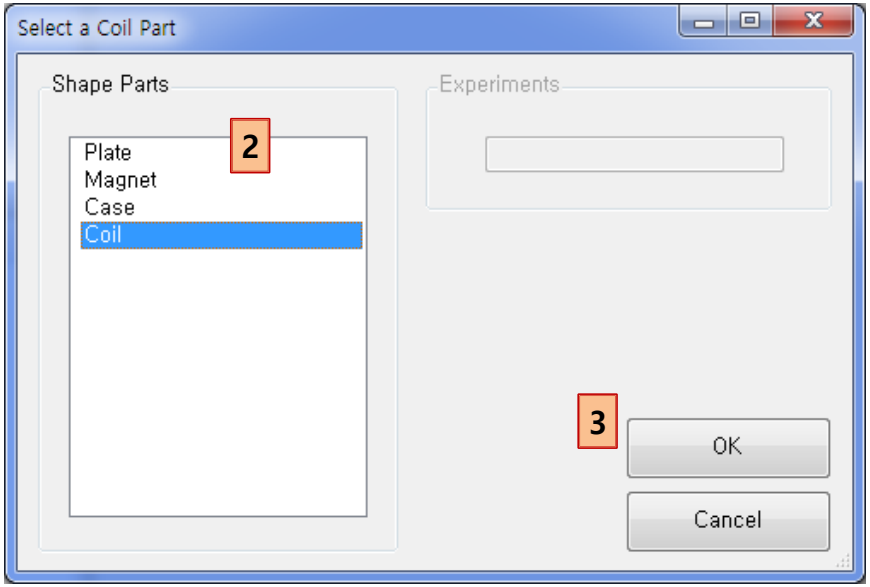


Parts Design

Coil 추가

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





Coil 설계

자기력 계산 파트 선정

1. Coil 기구사양 입력
   - ✓ Moving Parts : **MOVING**
   - ✓ Coil Wire Grade : Bonded_IEC_Grade_1B
   - ✓ Inner Diameter : 3
   - ✓ Outer Diameter : 3.73
   - ✓ Coil Height : 1.18
   - ✓ Copper Diameter : 0.045
   - ✓ Horizontal Coefficient : 0.95 (Bonded Type)
   - ✓ Vertical Coefficient : 1.13 (Bonded Type)
   - ✓ Resistance Coefficient : 1.1 (Bonded Type)

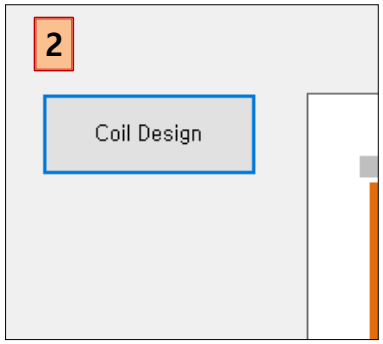
2. Coil 사양 계산
   - ✓ Design Coil 버튼 클릭

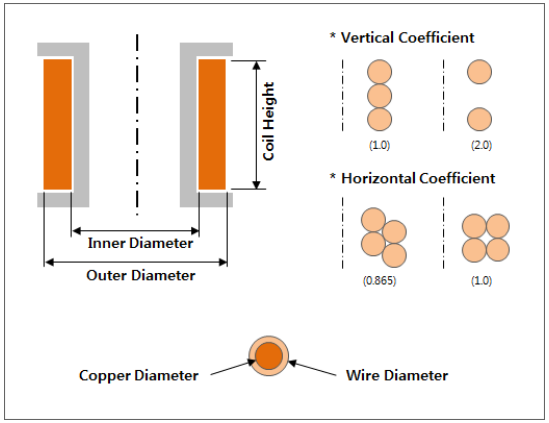
3. Coil 사양 확인

Common Fields	
Node Name	**Coil**
Specification Fields	
Part Material	**Copper**
Curent Direction	**IN**
Moving Parts	**MOVING**
Calculated Fields	
Coil Turns	**126**
Coil Resistance [Ω]	**15.74769**
Coil Layers	6
Turns of One Layer	21
Design Fields (optional)	
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 [℃]	**20**
Horizontal Coefficient	**0.95**
Vertical Coefficient	**1.13**
Resistance Coefficient	**1.1**

1

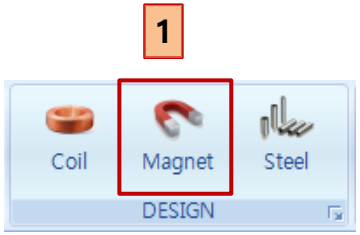
3

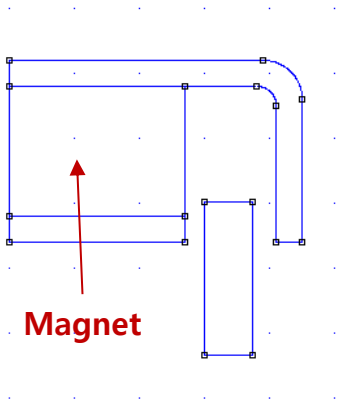


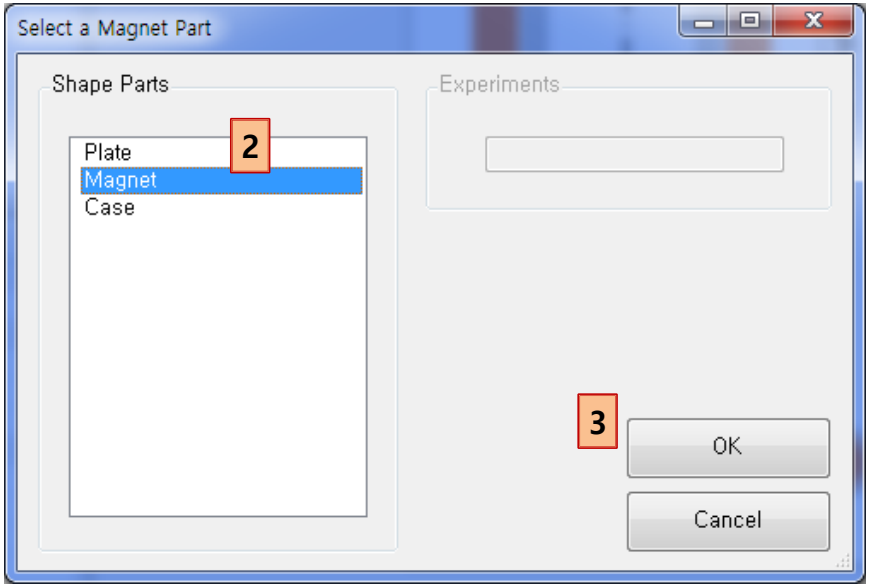


Magnet 추가

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





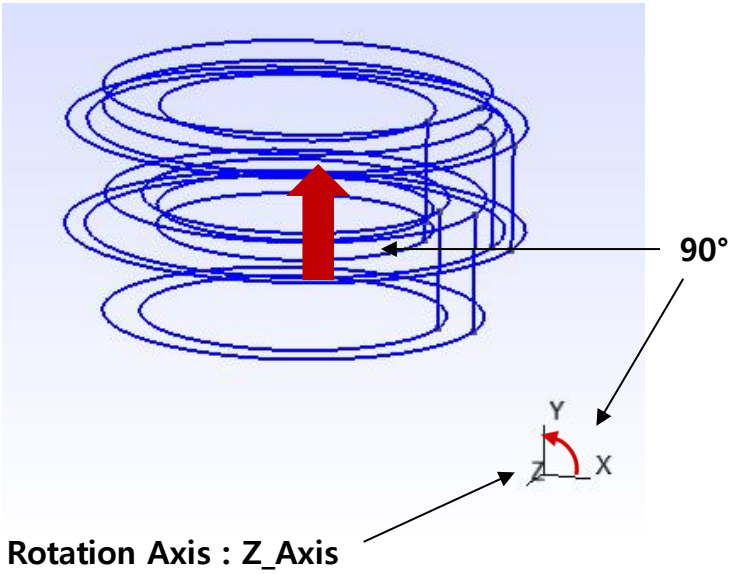


Magnet 설정

1. Magnet 속성 설정
   ✓ 기본 설정 값 사용

1

Common Fields	
Node Name	**Magnet**
Specification Fields	
Part Material	**NdFeB_40**
Hc	969969
Br	1.26497
Moving Parts	**FIXED**
Magnetization Fields	
Rotation Axis	**Z_AXIS**
Rotation Angle	**90**



[참고] 영구자석 착자

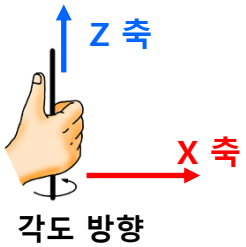
1. 영구자석 착자 방향 이해

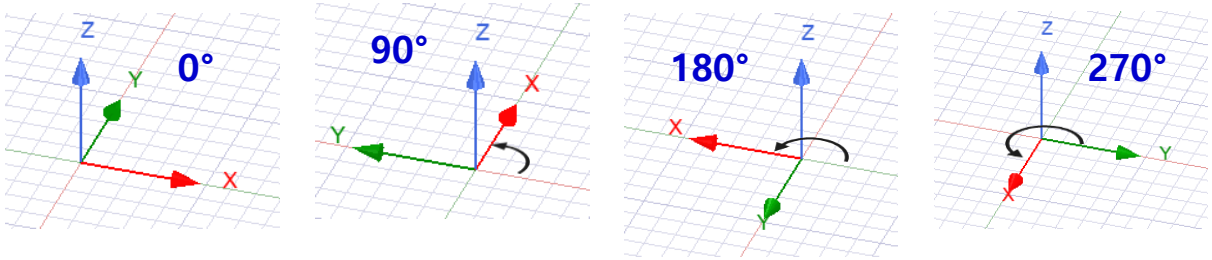
- 영구자석 착자 방향 : **X 축 방향**
- Rotation Axis : X 축의 회전 기준 축
- Rotation Angle : X 축이 회전하는 각도

Magnetization Fields	
Rotation Axis	Z_AXIS
Rotation Angle	90

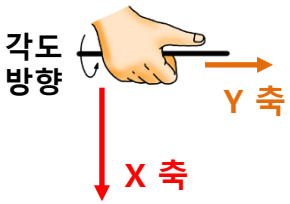
2. 착자 방향 설정

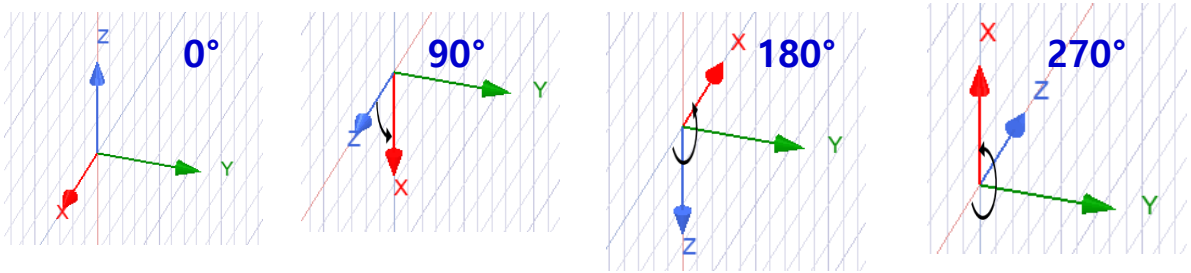
- **Rotation Axis : Z_Axis**





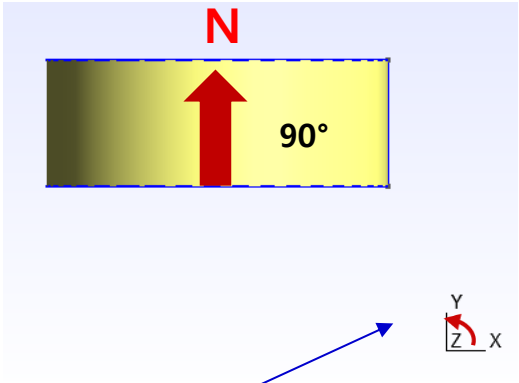
- **Rotation Axis : Y_Axis**





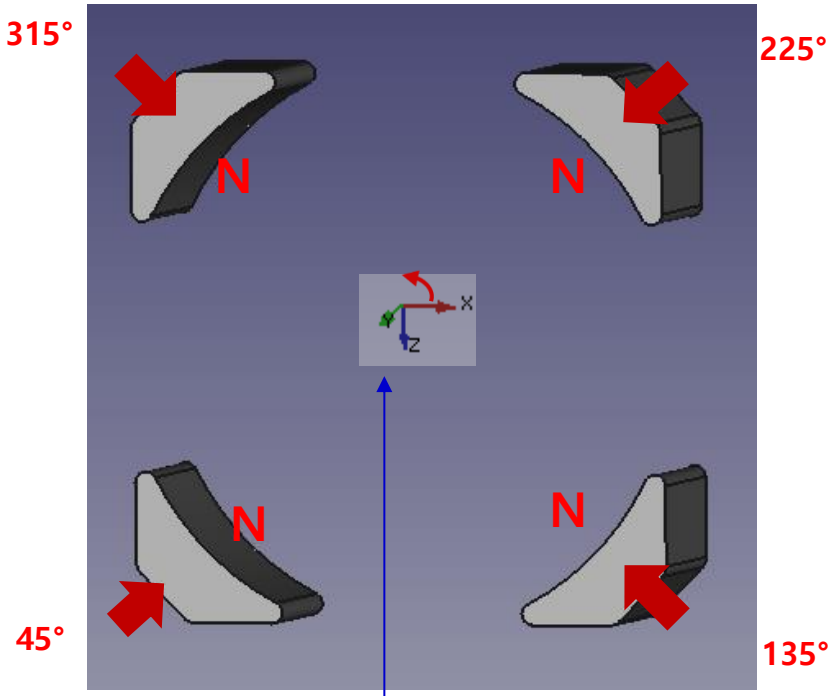
[참고] 영구자석 착자 사례

✓ Rotation Axis : Z_Axis
✓ Rotation Angle : 90



회전 축 : Z_Axis

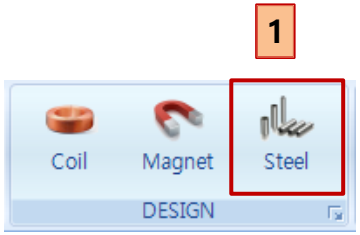
✓ Rotation Axis : Y_Axis
✓ Rotation Angle : 45°, 135°, 225°, 315°

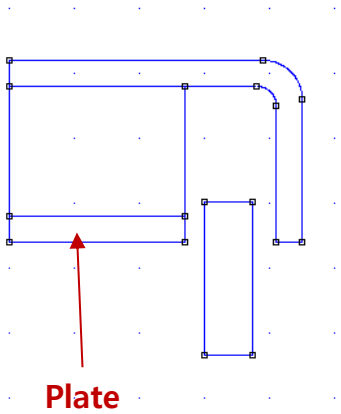


회전 축 : Y_Axis

Plate 추가

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





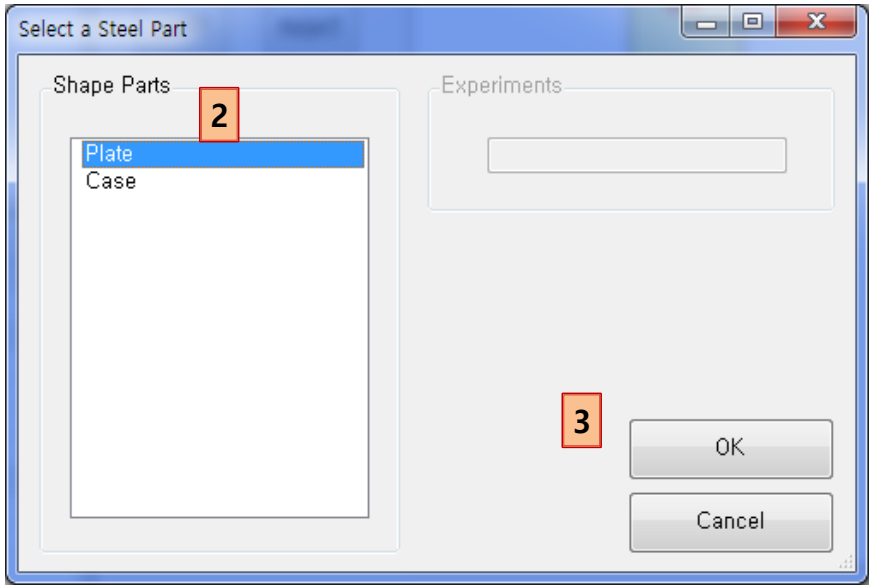
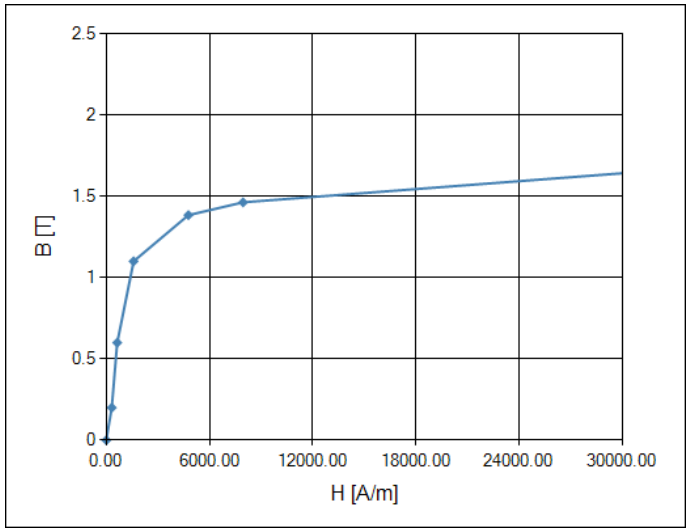


Plate 설정

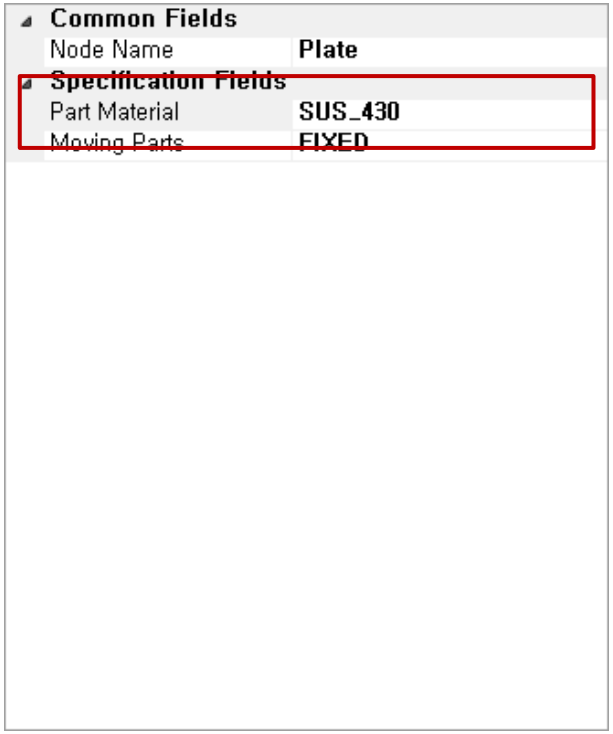
1. Plate 속성 설정

   ✓ Part Material : SUS_430 선택

[BH 곡선]

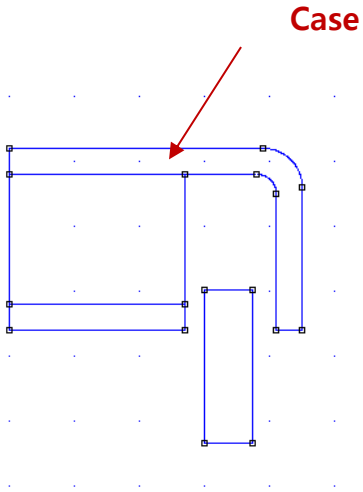


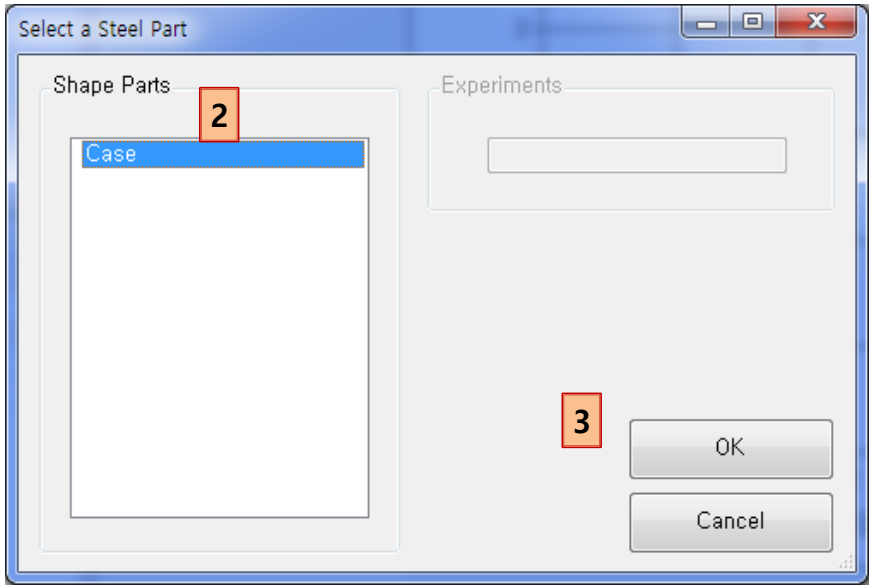
1



Case 추가

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



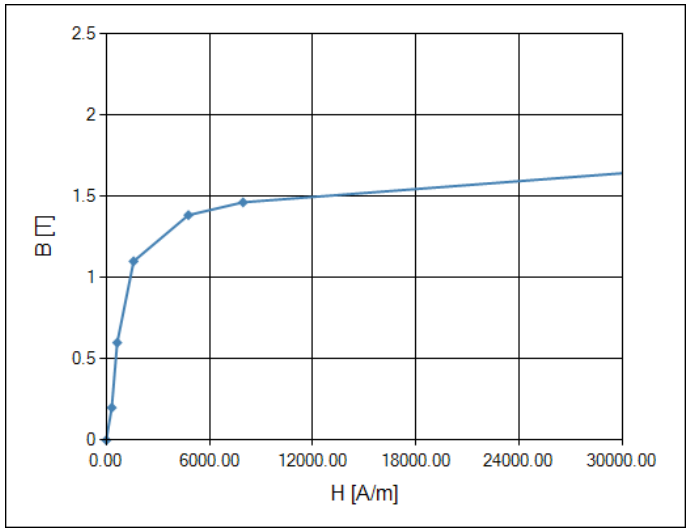


Case 설정

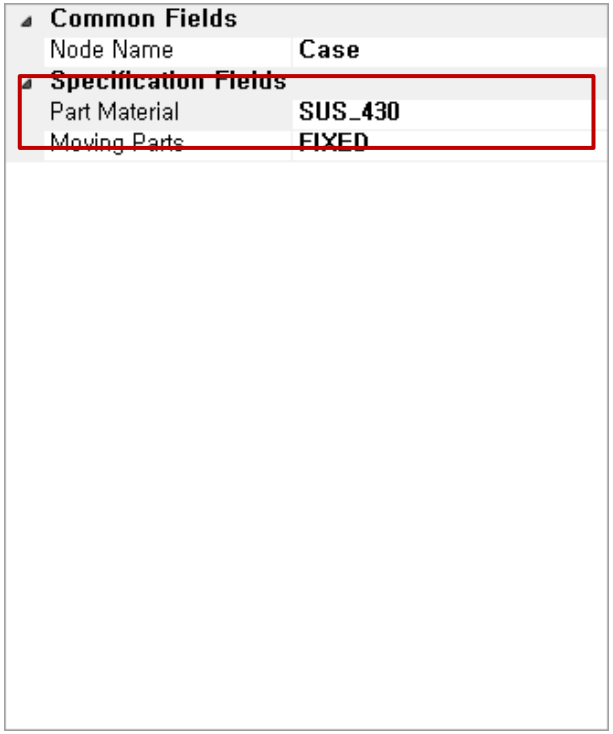
1. Case 속성 설정

   ✓ Part Material : SUS_430 선택

[BH 곡선]



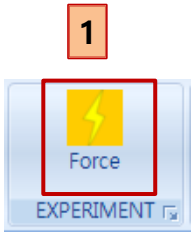
1

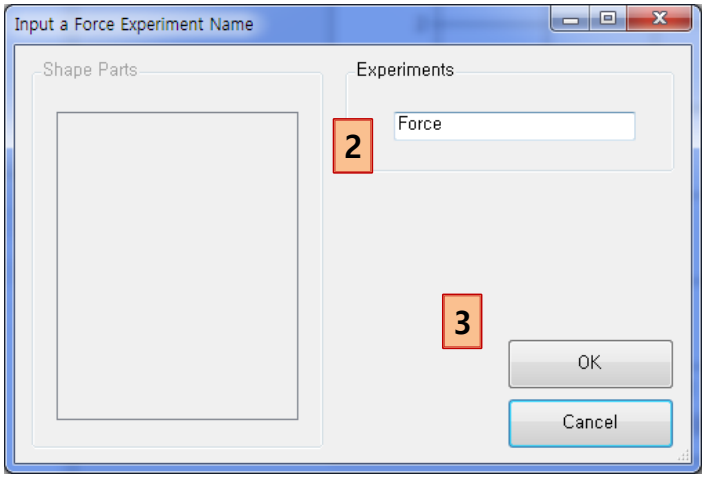


Virtual Test

자기력 가상실험

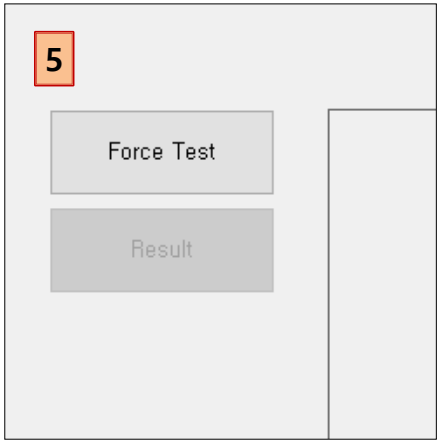
1. Toolbar > Force 버튼 클릭
2. Test Name : "Force"
3. OK 버튼 클릭
4. 자기력 가상실험 설정
   - ✓ Voltage : 2.5
   - ✓ B Rotation Angle : 45
   - ✓ B Vector Resolution : 80
   - ✓ Mesh Size Percent : 5
   - ✓ Actuator Type : **VCM**
5. Force Test 버튼 클릭





Common Fields	
Node Name	**Force**
Input Fields	
Voltage [V]	**2.5**
Max. Current [A]	0.15875
Initial Position Fields	
Y Movement [mm]	**0**
X Movement [mm]	**0**
Z Movement [mm]	**0**
Post-Processing Fields	
B Rotation Angle [°]	**45**
B Vector Resolution	**80**
Condition Fields	
Mesh Size [%]	**5**
Actuator Type	**VCM**

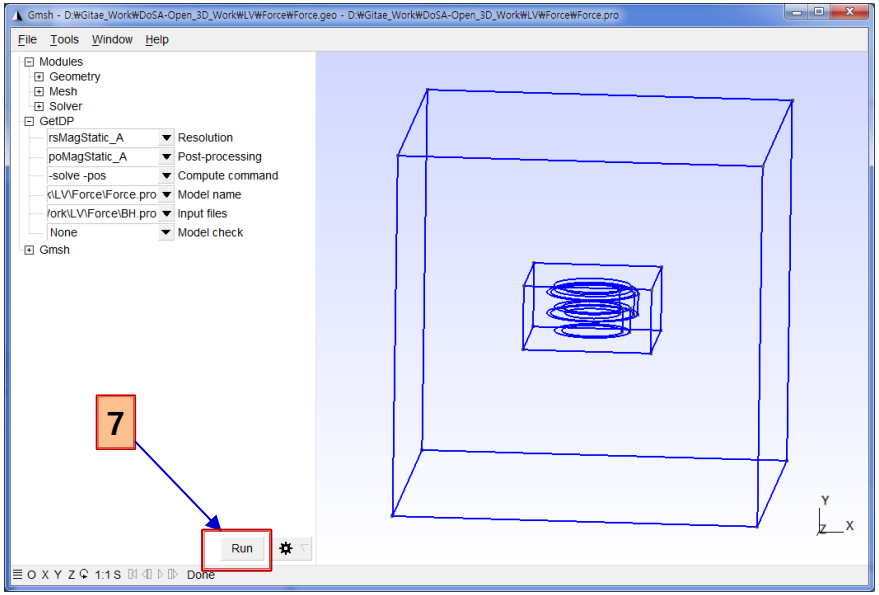
4

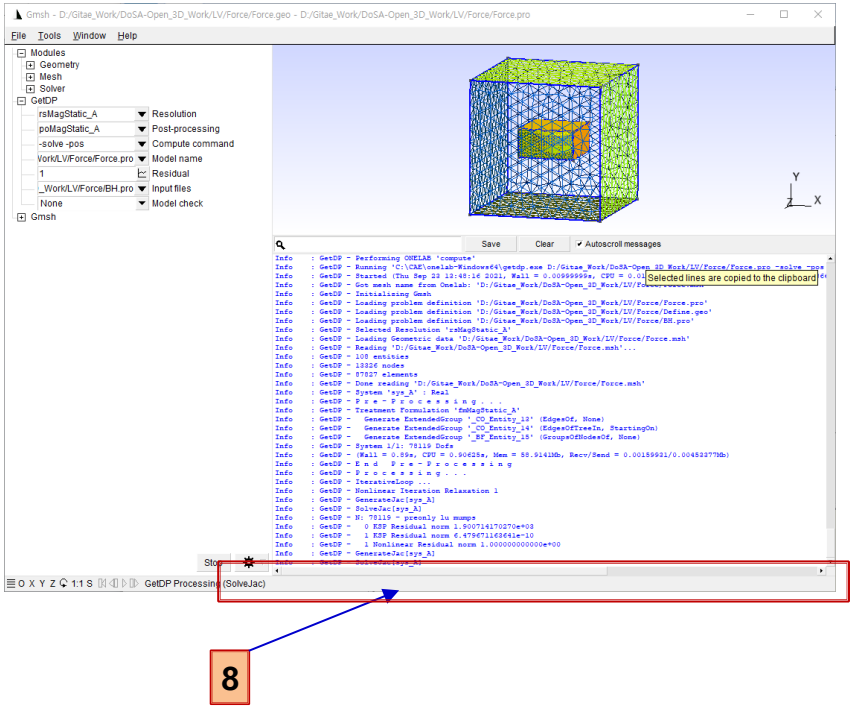


자기력 가상실험 실행

7. 형상을 확인 하고 Run 버튼 클릭한다

8. 해석 진행 중에 상황을 확인하려면 Gmsh 상태 바를 클릭한다



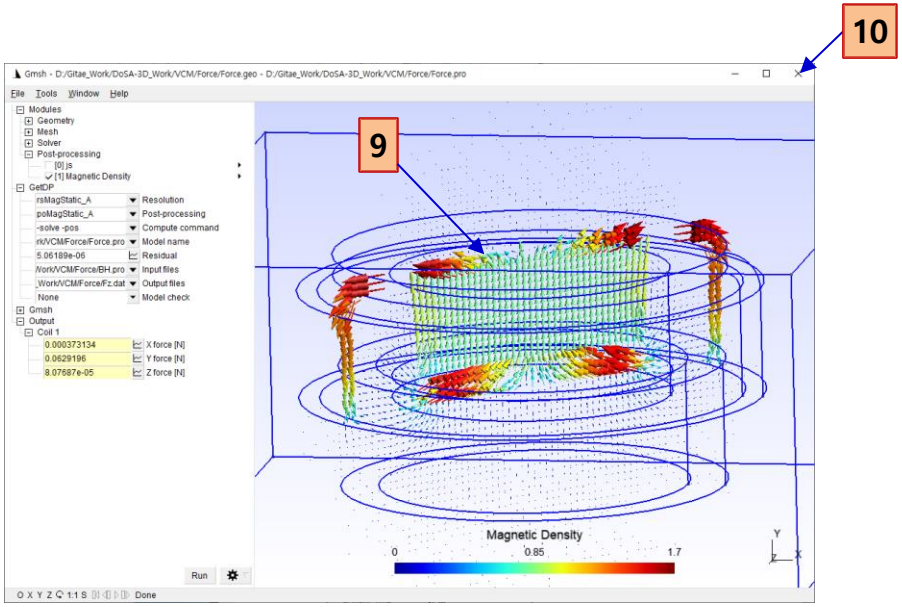


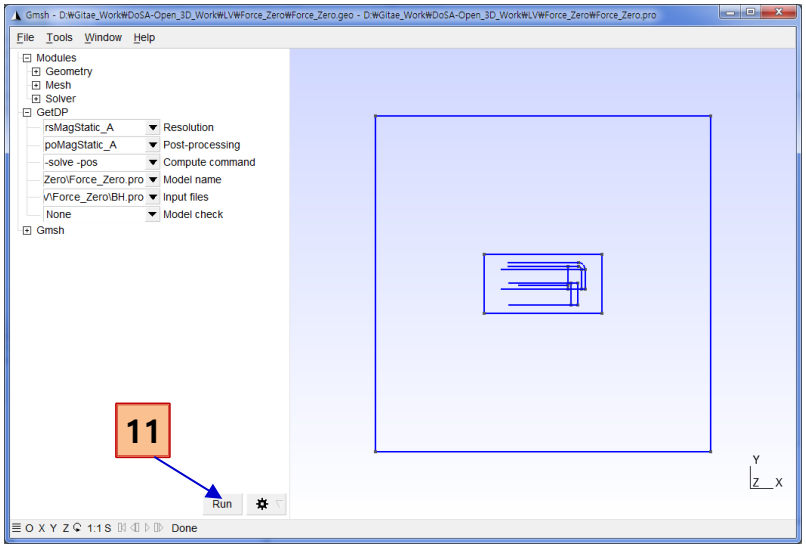
자기력 가상실험 실행

9. 자속밀도를 확인 한다 (해석 시간은 컴퓨터 사양에 따라 다름)

10. **Gmsh 를 종료한다** (종료하면 자동으로 Gmsh 가 다시 실행됨)

11. 다시 Run 버튼을 클릭한다 (**VCM 방식 액추에이터는 자기력 정확도를 높이기 위해 두 번 해석을 진행함**)

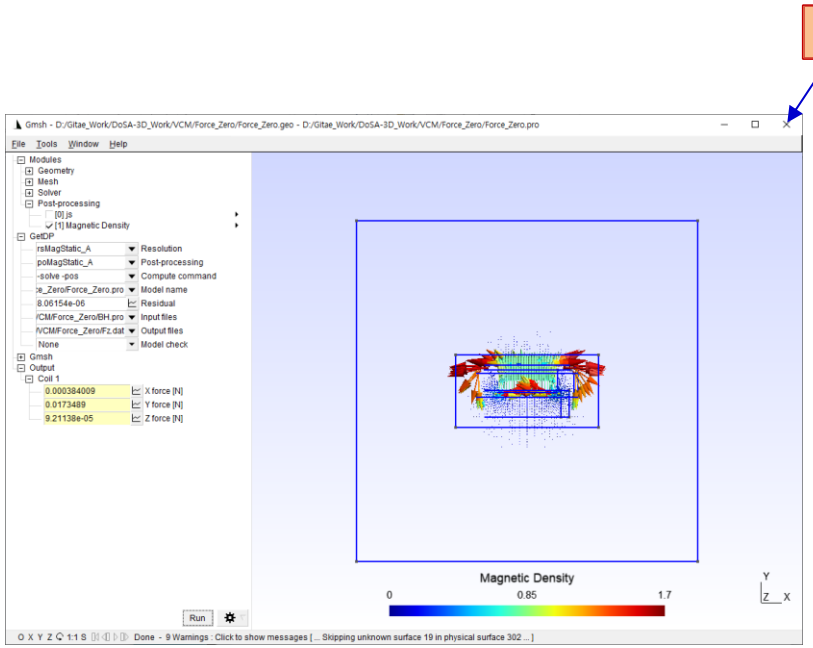


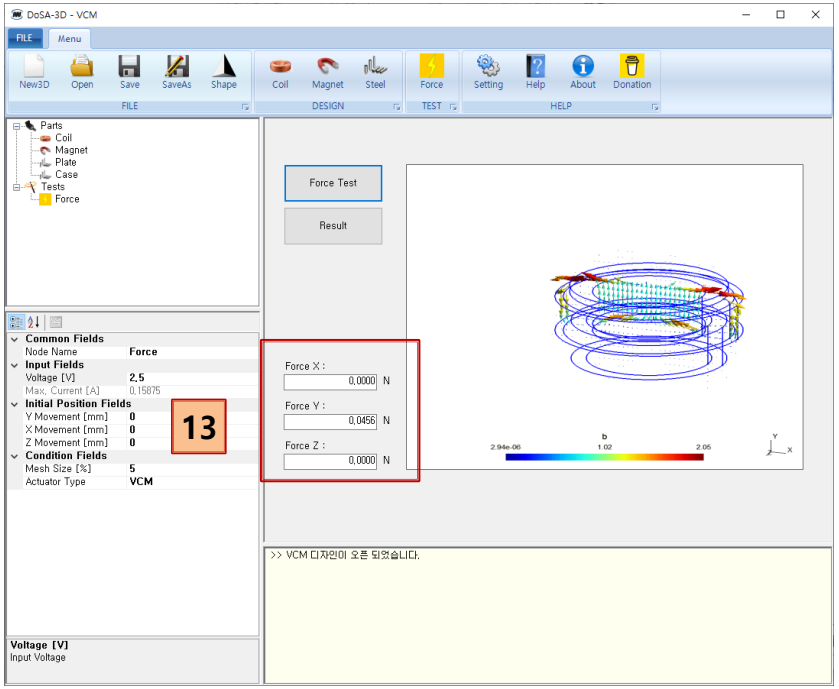


자기력 가상실험 결과

12. 다시 실행된 Gmsh 를 종료한다

13. DoSA-3D 에서 VCM 의 자기력을 확인한다

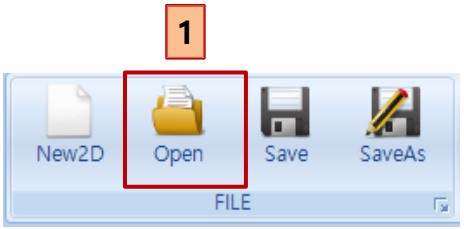


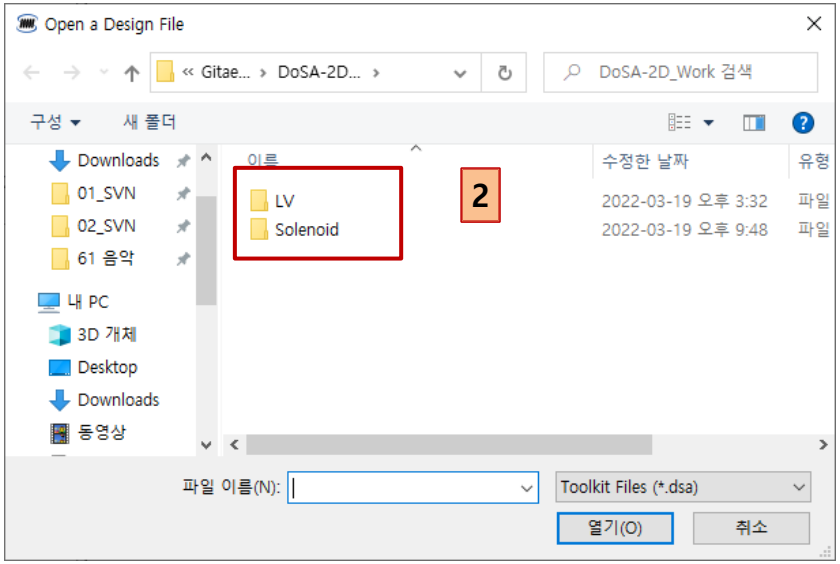


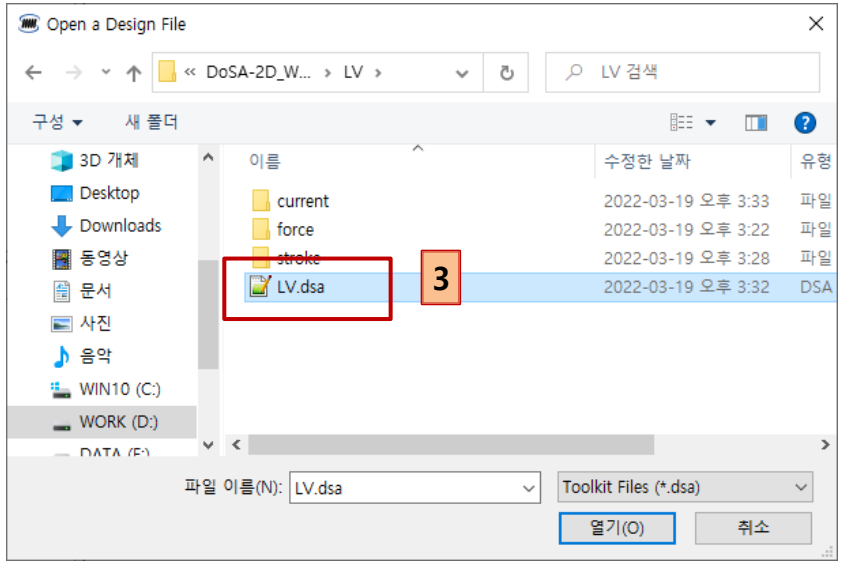
Tips

Design 열기

1. Toolbar > Open 버튼 클릭
2. Design 디렉토리 더블 클릭
3. Design 파일 더블 클릭







감사합니다

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