

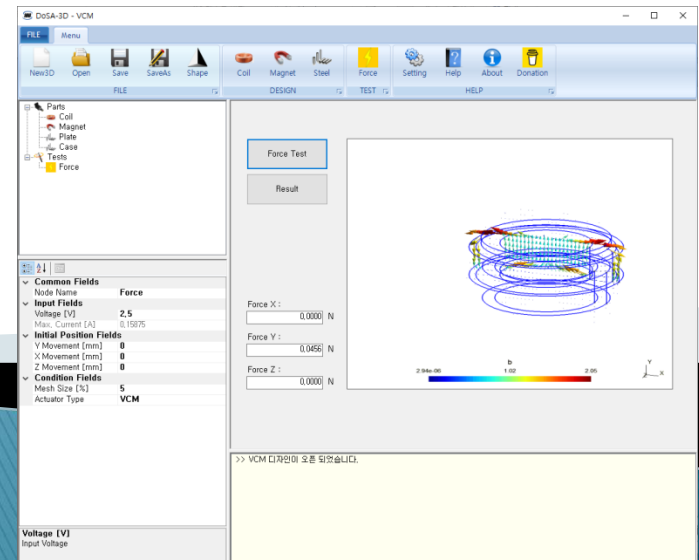
DoSA-3D 사용 메뉴얼

Voice Coil Motor Example

(Speaker, Auto-Focus, Linear Vibrator)

2022-06-05

zgitae@gmail.com



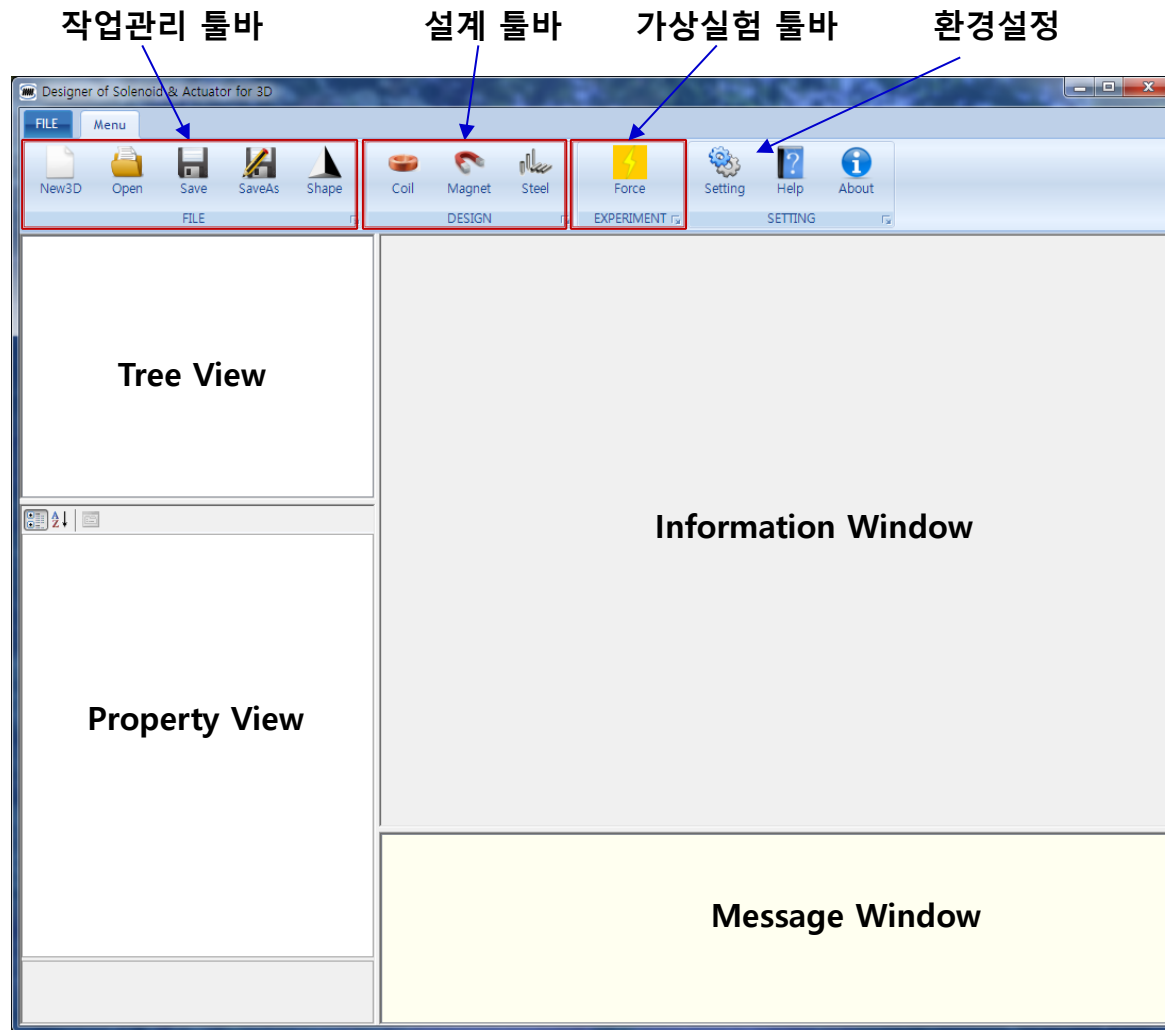
DoSA 구성

PC 요구사항

- CPU : 4 Core 이상
- RAM : 16GB 이상



프로그램 구성



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



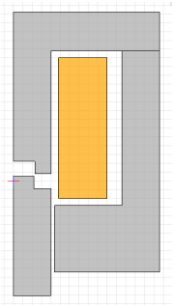
작업 흐름

제품 설계

가상 실험

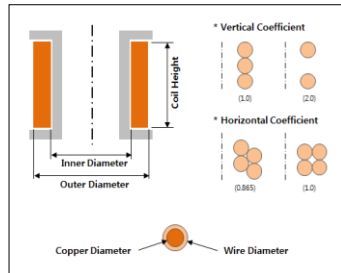
1. 형상설계

Geometry



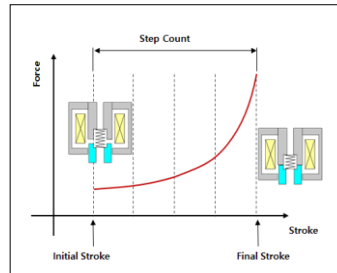
2. 부품설계

Components



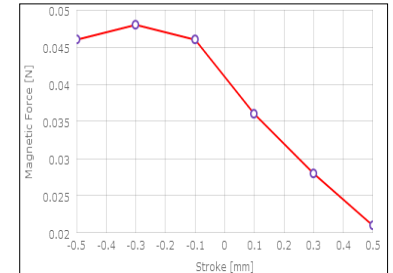
3. 시험조건

Test Condition



4. 가상실험 (자동실행)

Virtual Test



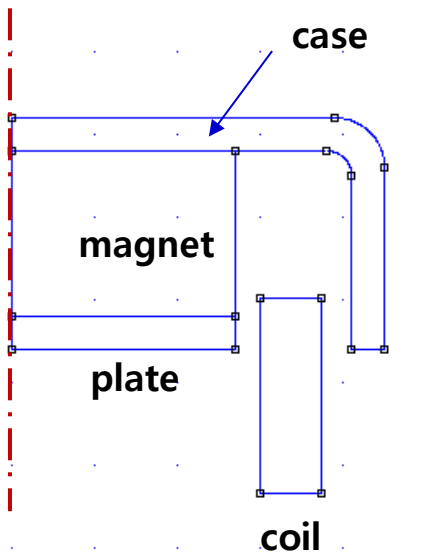
5. 결과확인

Results

해석 모델

해석모델 설명

1. 형상 모델



2. 제품 사양

가. 코일권선

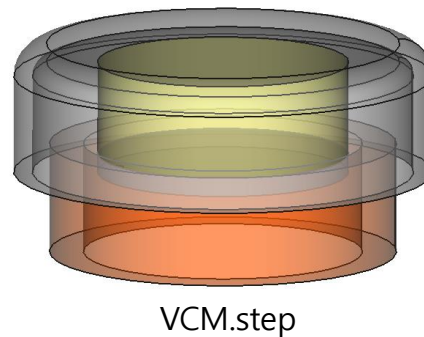
- Coil Turns : 126 turns
- Coil Resistance : 15.75 Ohm

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

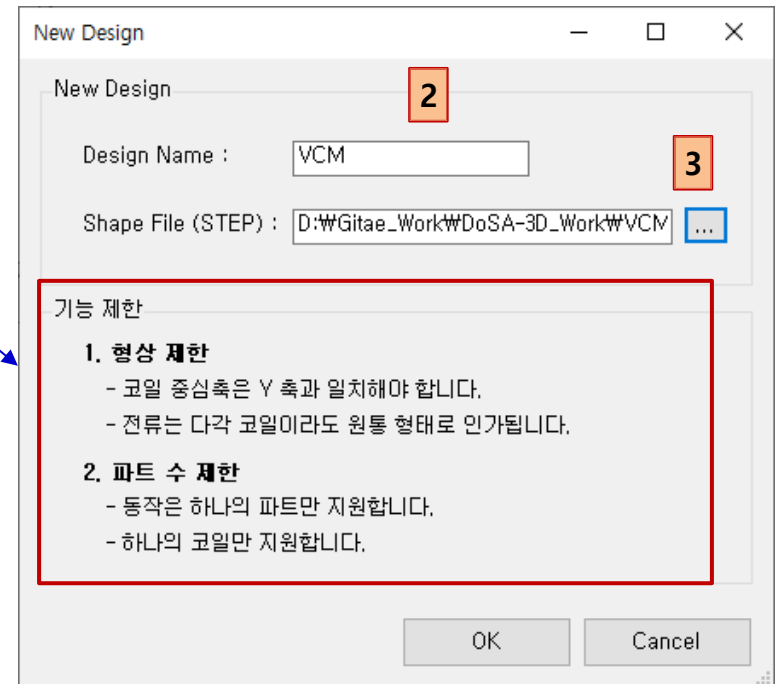
- 코일 중심축은 Y 축과 일치해야 합니다.
- 전류는 다각 코일이라도 원통 형태로 인가됩니다.
(다각 코일의 경우 약간의 차이가 발생할 수 있음)

나. 파트 수 제한

- 동작은 하나의 파트만 지원합니다.
- 하나의 코일만 지원합니다.

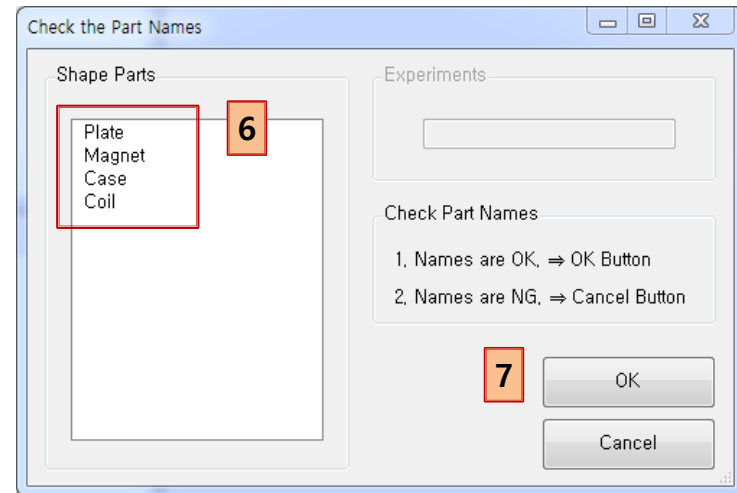
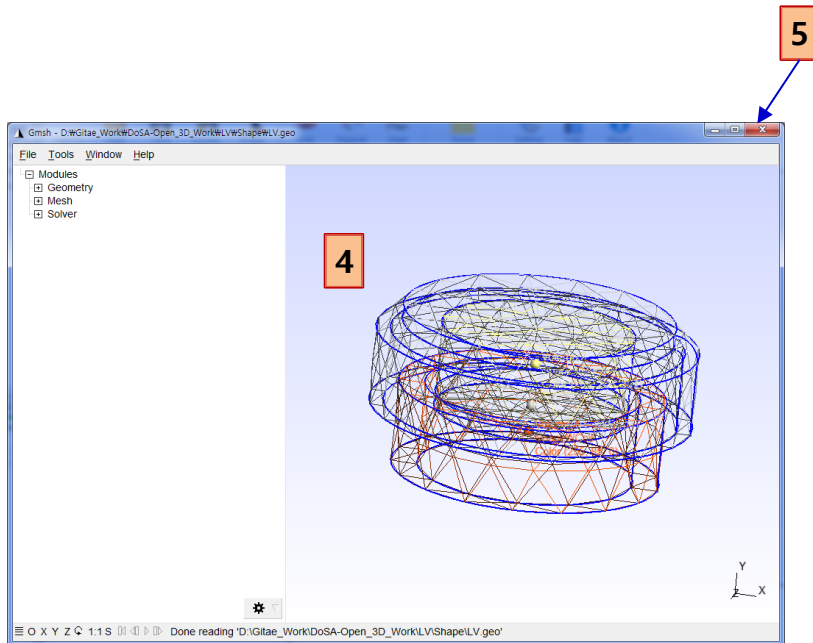
다. 형상작업 가이드

- https://solenoid.or.kr/data/Drawing_Guide_KOR.pdf



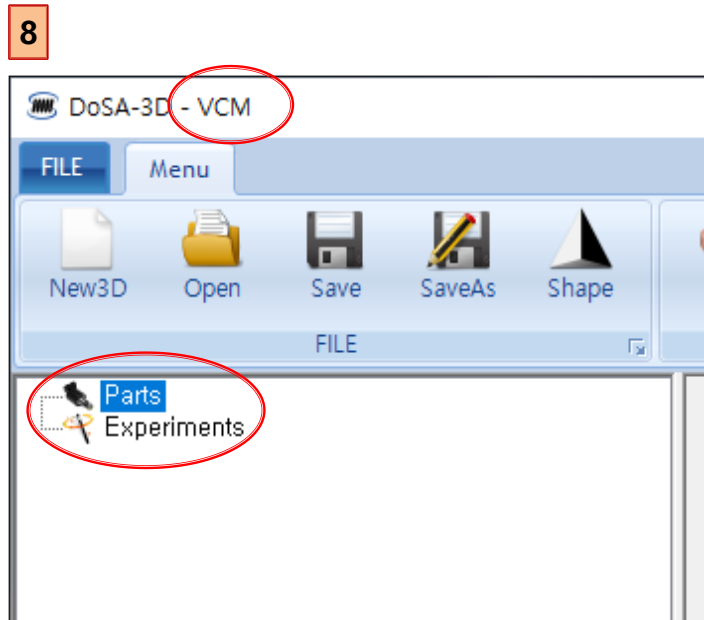
Design 생성

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

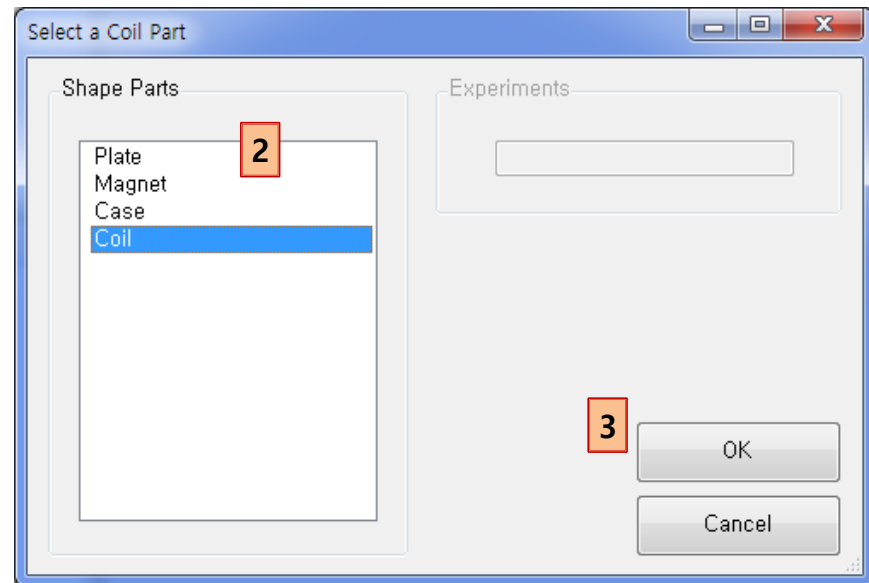
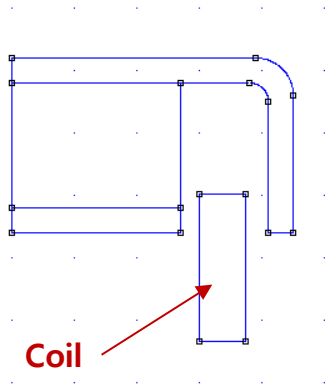
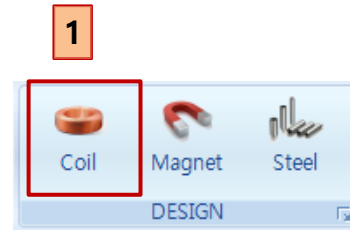
8. Design 생성을 확인한다.



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

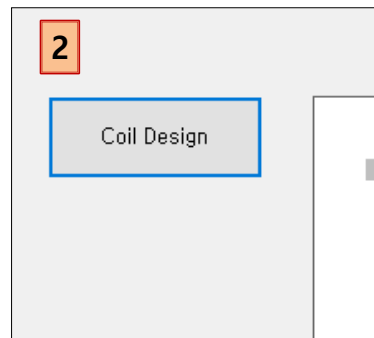
1. Coil 기구사양 입력

- ✓ 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

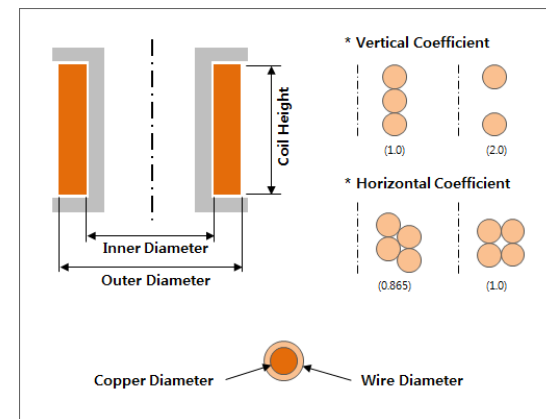
3. Coil 사양 확인



1

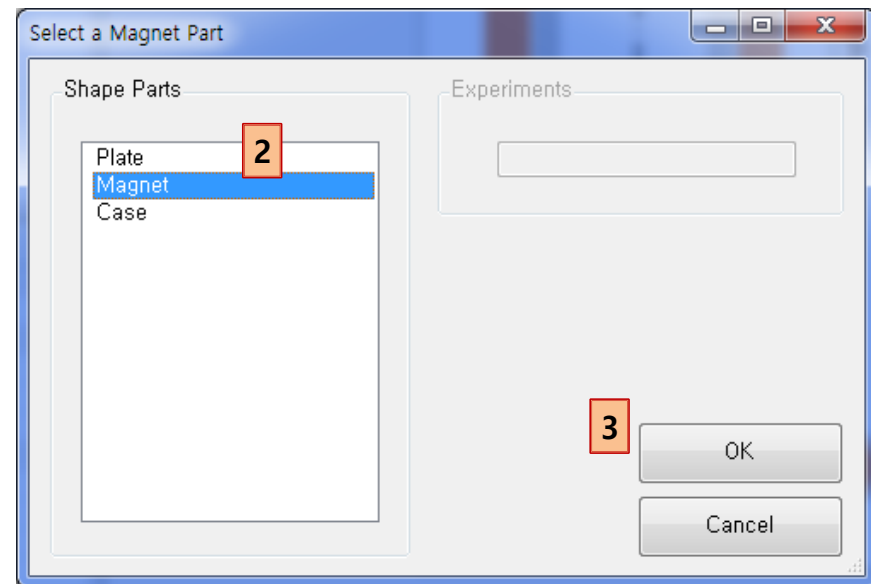
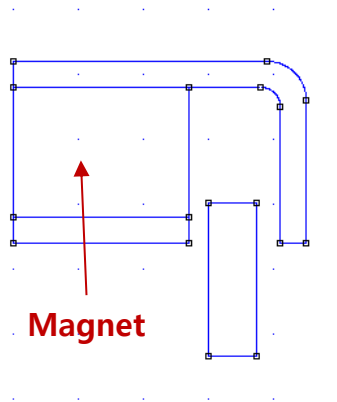
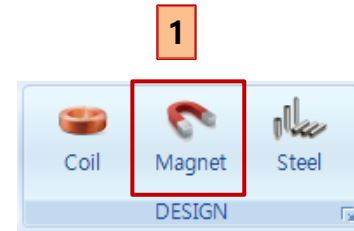
Common Fields	
Node Name	Coil
Specification Fields	
Part Material	Copper
Curent Direction	IN
Moving Parts	MOVING
Calculated Fields	
Coil Turns	126
Coil Resistance [Ω]	15,74769
Coil Layers	6
Turns of One Layer	21
Design Fields (optional)	
Coil Wire Grade	Bonded_IEC_Grade_1B
Inner Diameter [mm]	3
Outer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

3



Magnet 추가

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

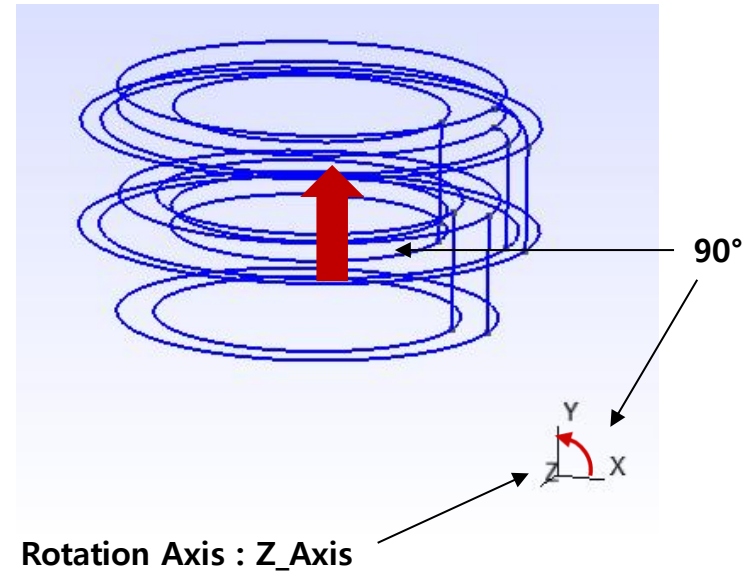


Magnet 설정

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

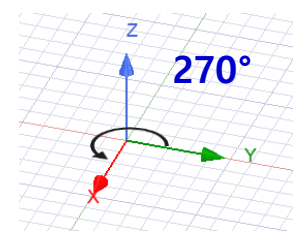
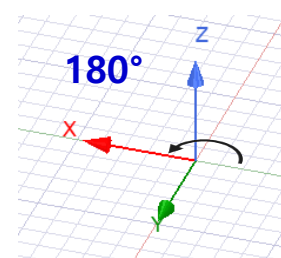
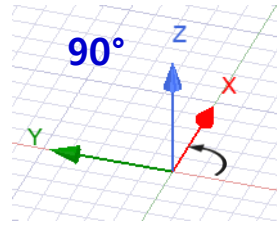
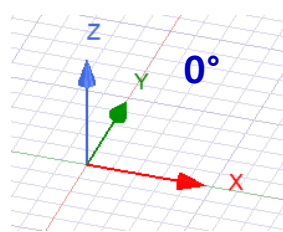
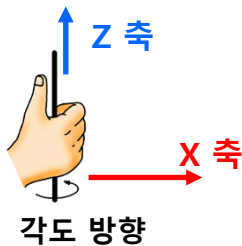
- 영구자석 착자 방향 : **X 축 방향**
- Rotation Axis : X 축의 회전 기준 축
- Rotation Angle : X 축이 회전하는 각도

▼ Magnetization Fields

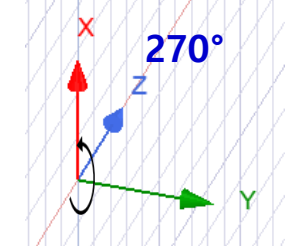
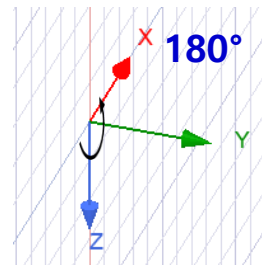
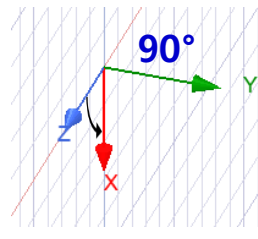
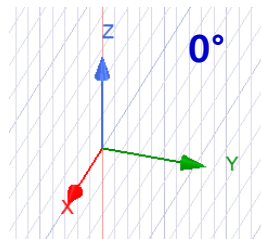
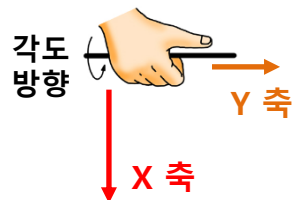
Rotation Axis	Z_AXIS
Rotation Angle	90

2. 착자 방향 설정

- Rotation Axis : Z_Axis

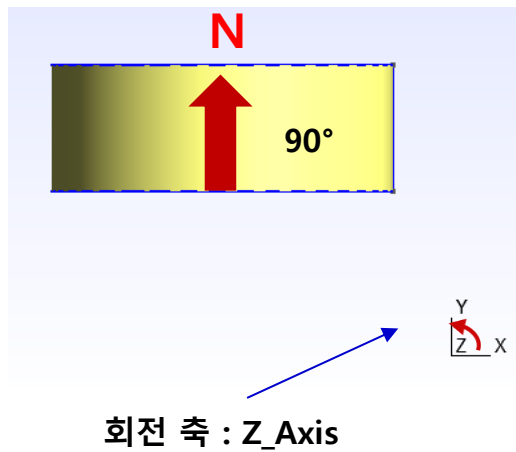


- Rotation Axis : Y_Axis



[참고] 영구자석 착자 사례

- ✓ Rotation Axis : Z_Axis
- ✓ Rotation Angle : 90°



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

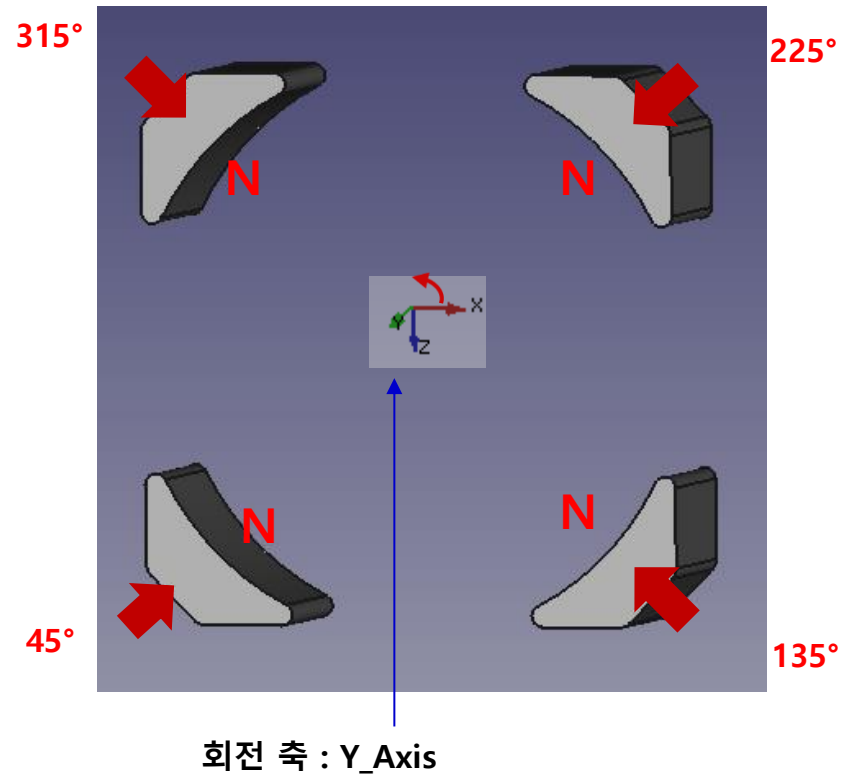


Plate 추가

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

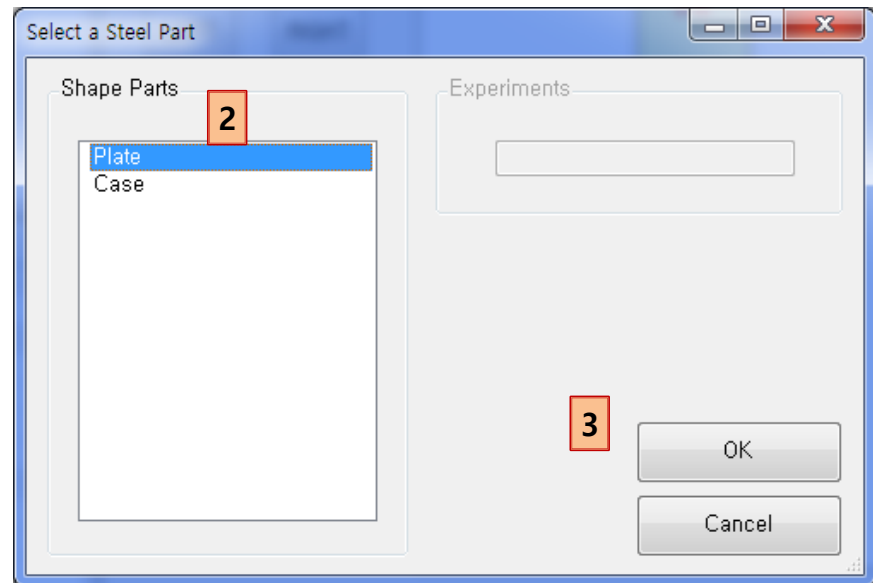
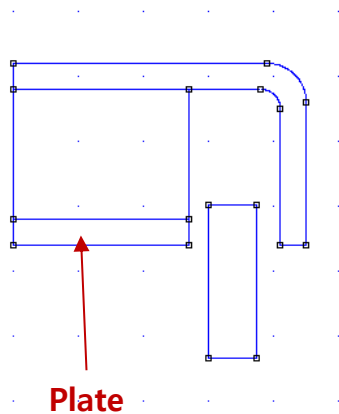
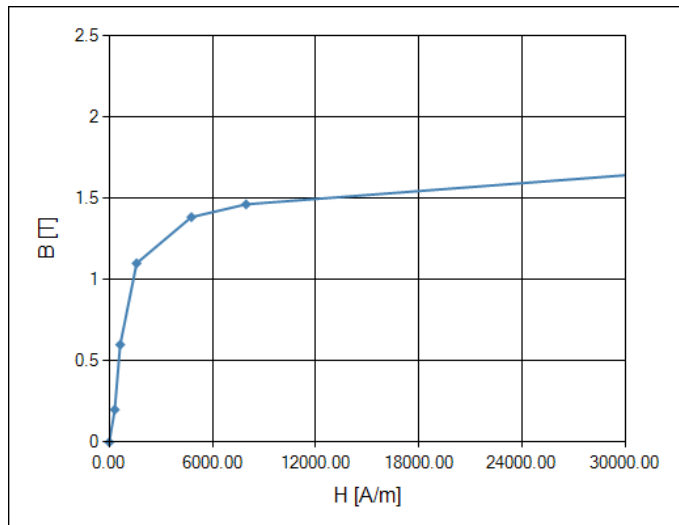


Plate 설정

1. Plate 속성 설정

- ✓ Part Material : SUS_430 선택

[BH 곡선]

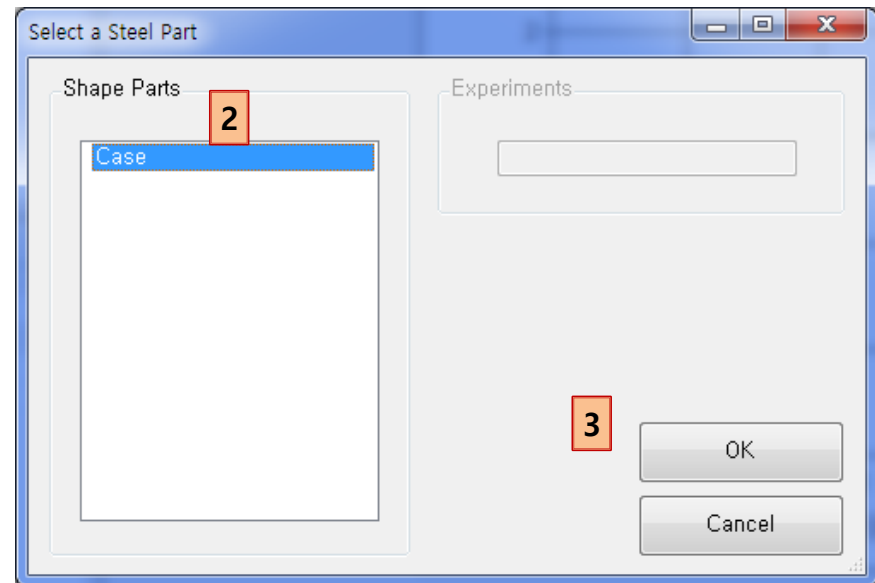
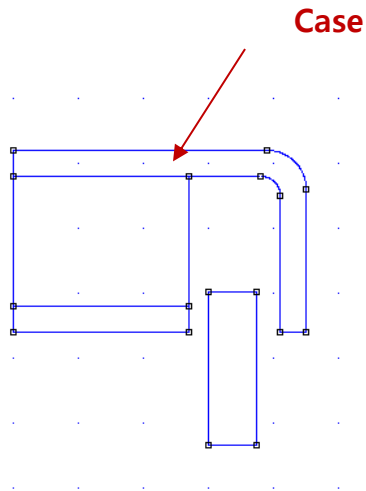
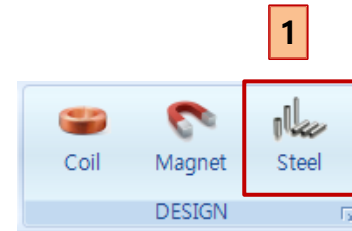


1

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

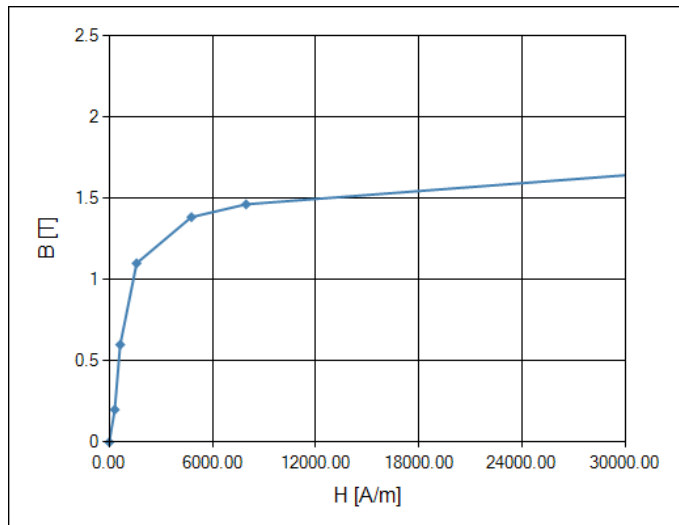


Case 설정

1. Case 속성 설정

- ✓ Part Material : SUS_430 선택

[BH 곡선]



1

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

Virtual Test

자기력 가상실험

1. Toolbar > Force 버튼 클릭

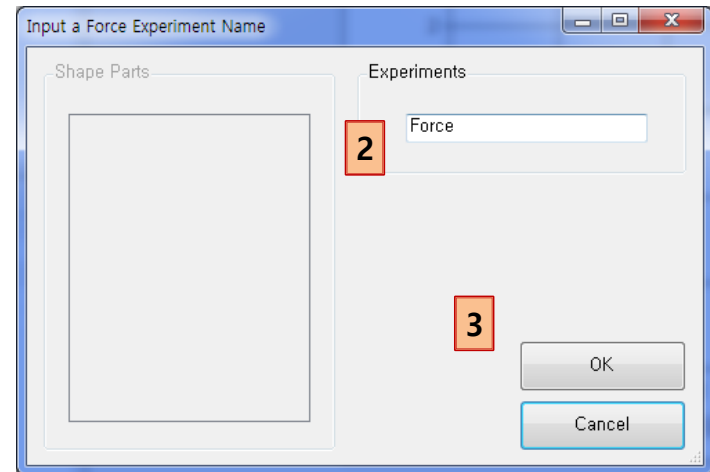
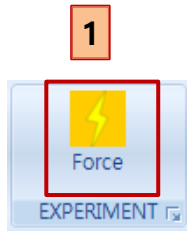
2. Test Name : "Force"

3. OK 버튼 클릭

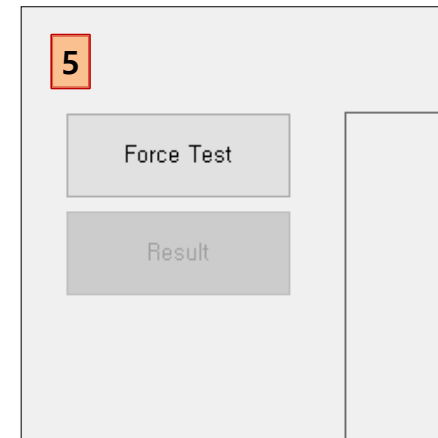
4. 자기력 가상실험 설정

- ✓ Voltage : 2.5
- ✓ B Rotation Angle : 45
- ✓ B Vector Resolution : 80
- ✓ Mesh Size Percent : 7
- ✓ Actuator Type : **VCM**

5. Force Test 버튼 클릭

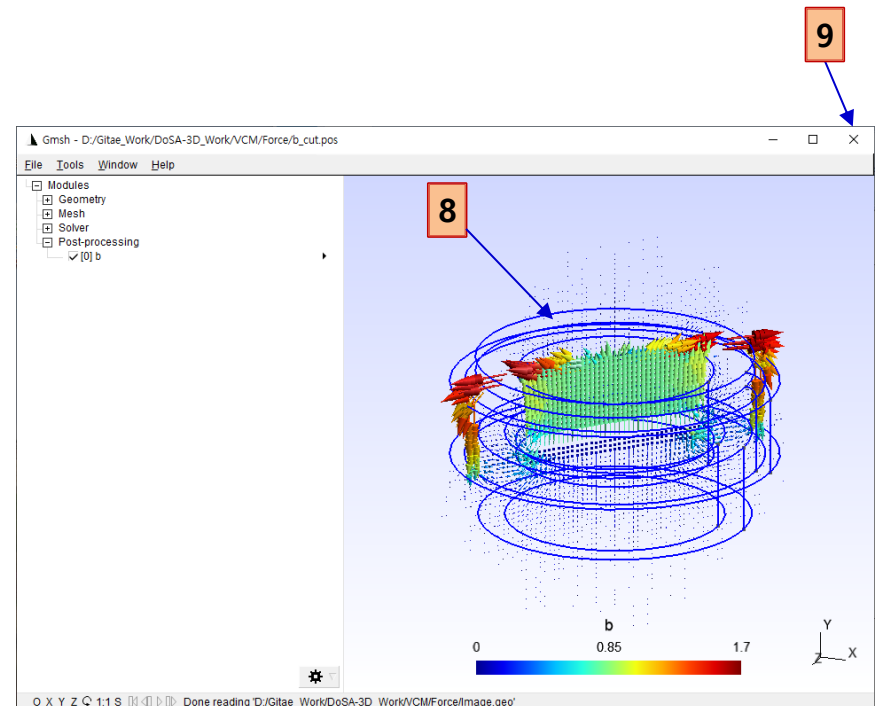
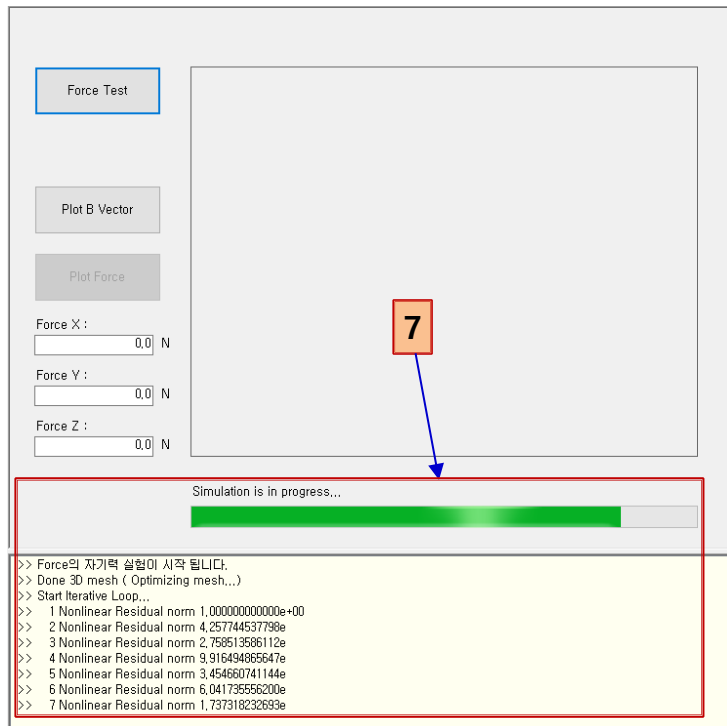


✓ Common Fields	
Node Name	Force
✓ Input Fields	
Voltage [V]	2.5
Max. Current [A]	0.15875
✓ Initial Position Fields	
X Movement [mm]	0
Y Movement [mm]	0
Z Movement [mm]	0
✓ Post-Processing Fields	
B Rotation Angle [°]	45
B Vector Resolution	80
✓ Condition Fields	
Mesh Size [%]	7
Actuator Type	VCM



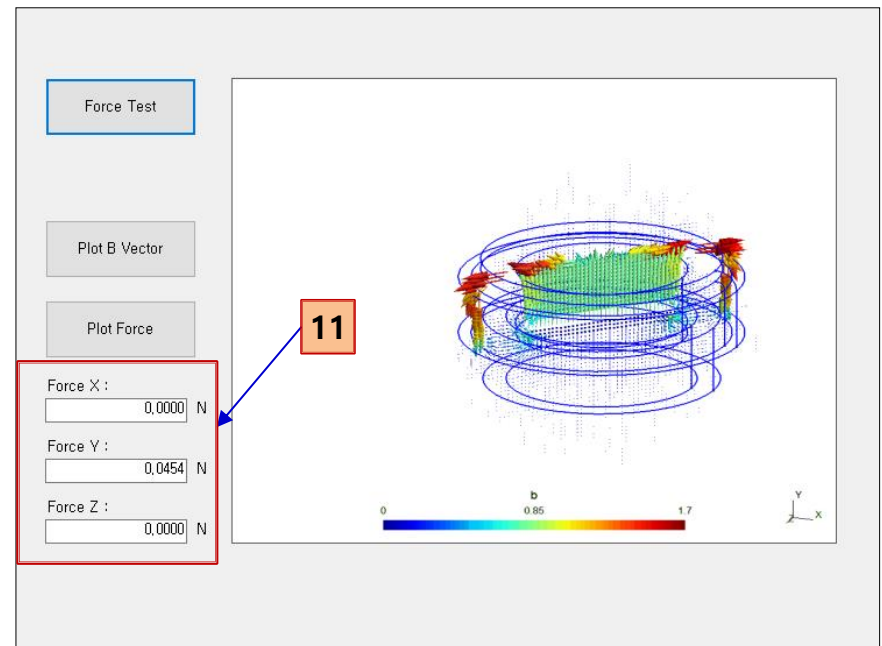
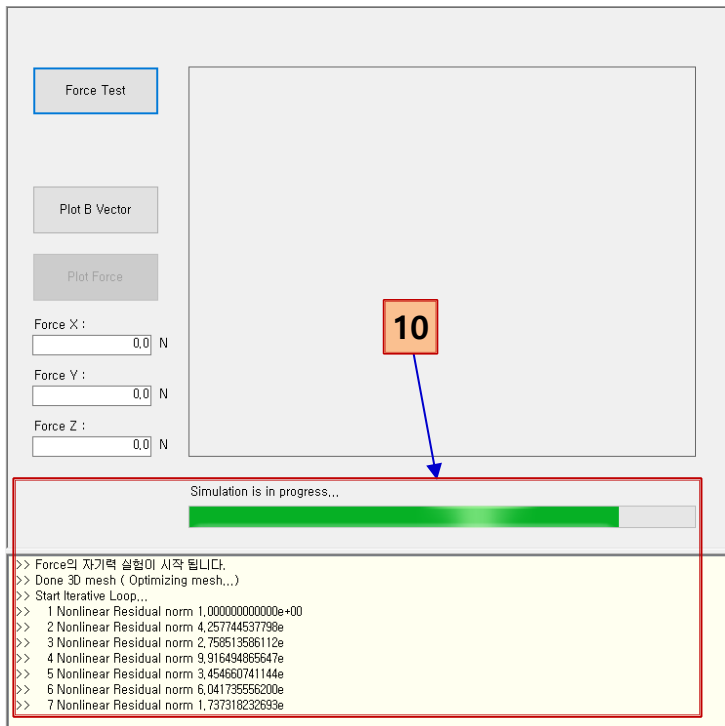
자기력 가상실험 실행

7. 자기력 해석 진행 상황을 확인한다.
8. 자속밀도를 확인 한다. (해석 시간은 컴퓨터 사양에 따라 다름)
9. **Gmsh** 를 종료한다.



자기력 가상실험 실행

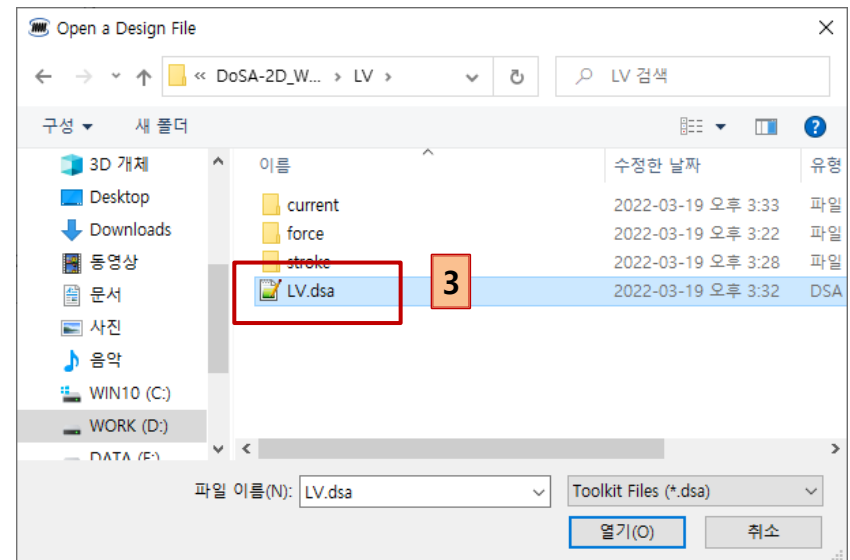
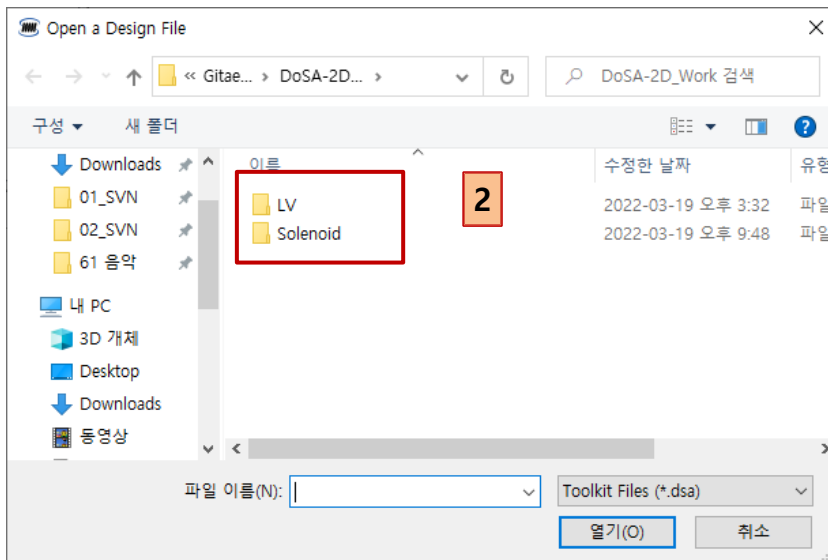
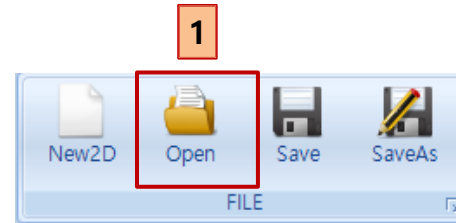
10. VCM 방식은 자기력 정확도를 높이기 위해 추가 해석이 자동으로 진행 된다.
11. DoSA-3D 에서 VCM 의 자기력을 확인한다.



Tips

Design 열기

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



감사합니다

Email : zgitae@gmail.com