

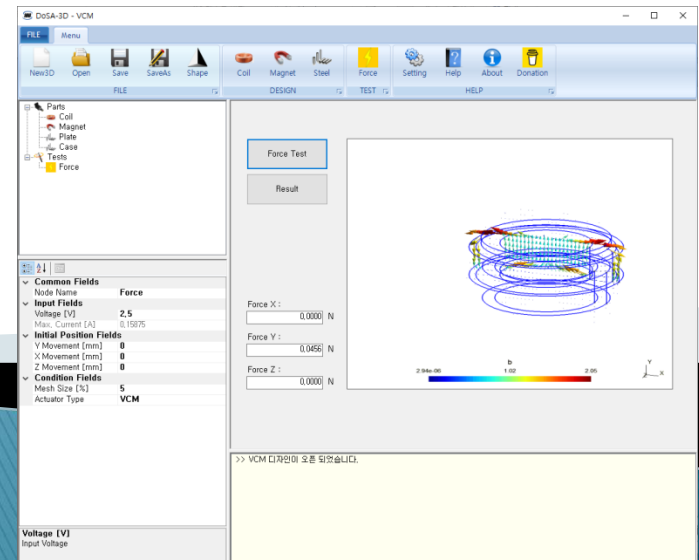
# DoSA-3D 사용 메뉴얼

## Voice Coil Motor Example

( Speaker, Auto-Focus, Linear Vibrator )

2022-06-25

zgitae@gmail.com



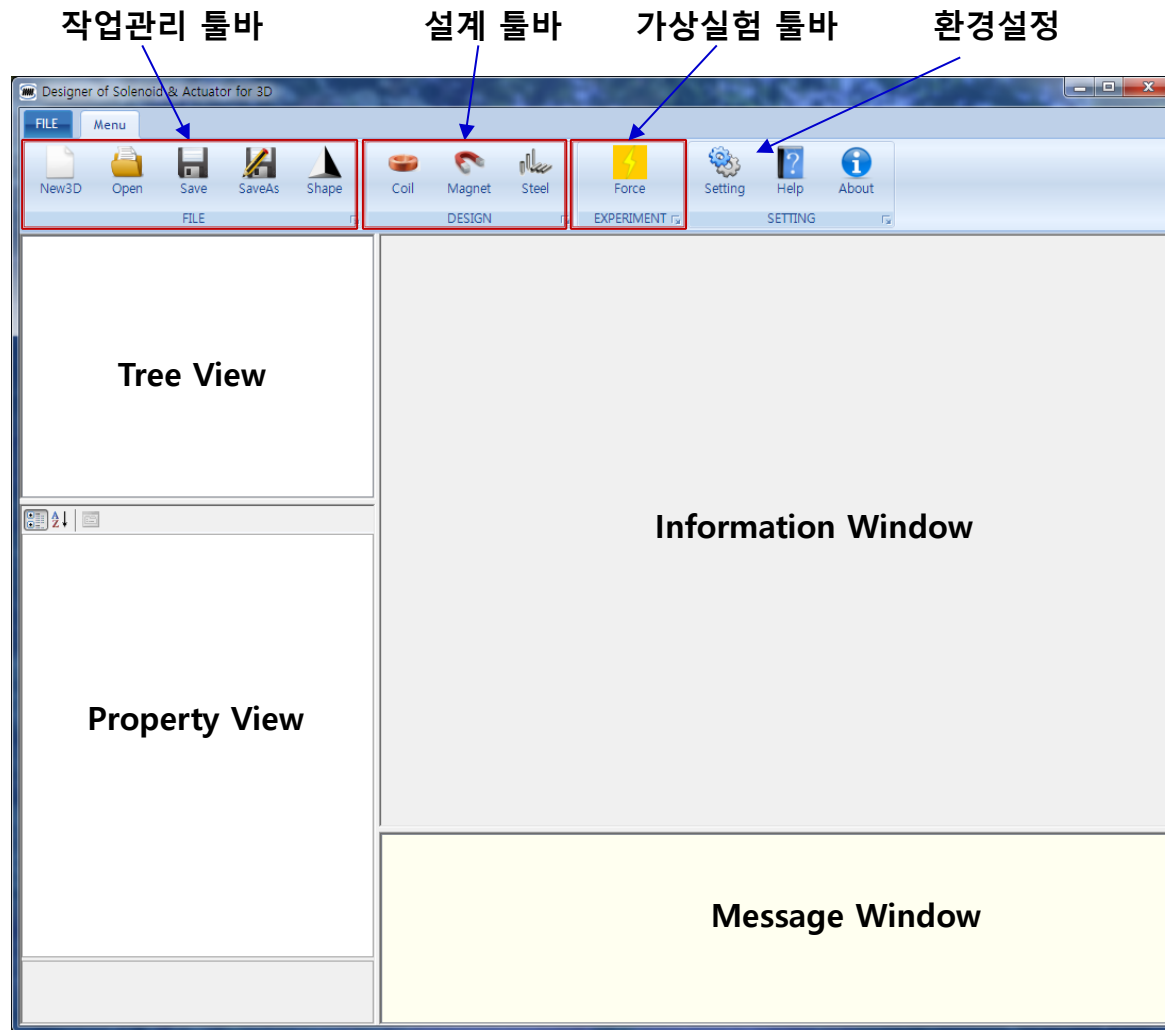
# DoSA 구성

# PC 요구사항

- CPU : 4 Core 이상
- RAM : 16GB 이상



# 프로그램 구성



# Ribbon Bar

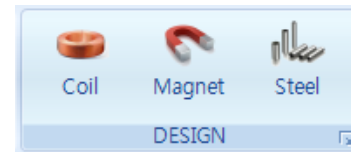
## 1. 작업관리

- ✓ 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



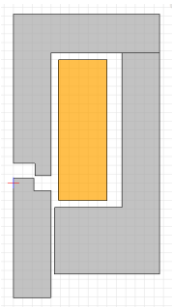
# 작업 흐름

## 제품 설계

## 가상 실험

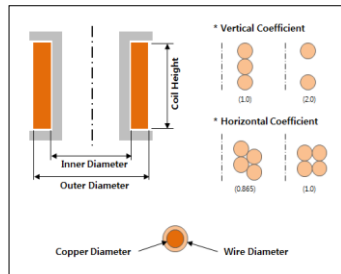
### 1. 형상설계

Geometry



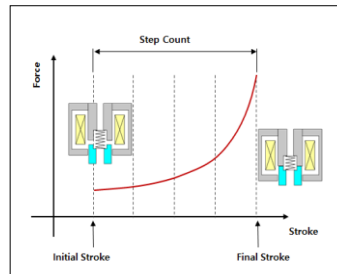
### 2. 부품설계

Components



### 3. 시험조건

Test Condition

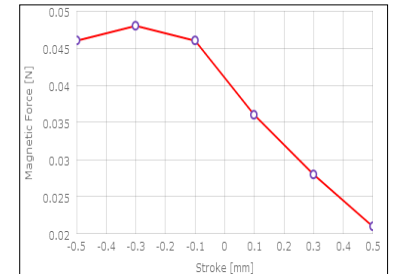


### 4. 가상실험 (자동실행)

Virtual Test

### 5. 결과확인

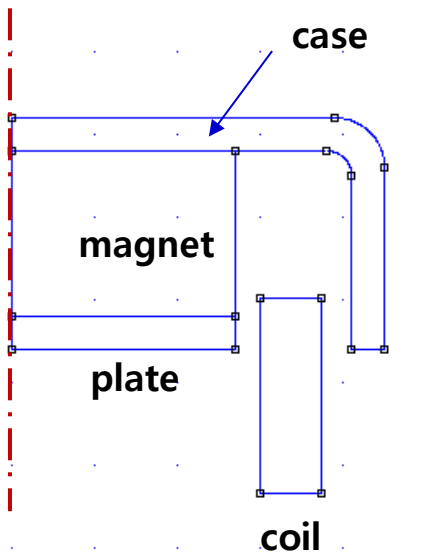
Results



# 해석 모델

# 해석모델 설명

## 1. 형상 모델



## 2. 제품 사양

### 가. 코일권선

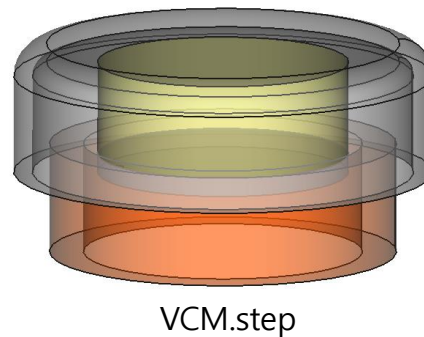
- Coil Turns : 126 turns
- Coil Resistance : 15.75 Ohm

### 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

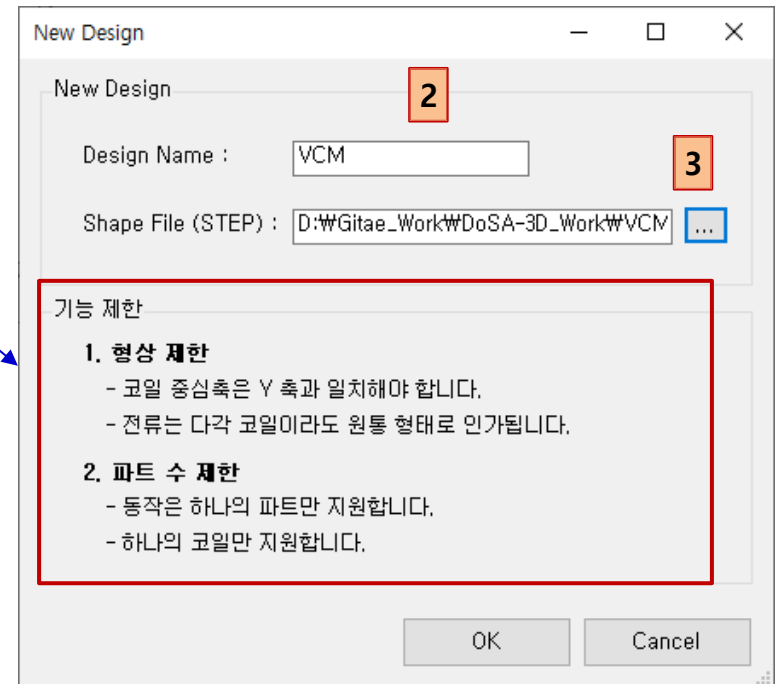
- 코일 중심축은 Y 축과 일치해야 합니다.
- 전류는 다각 코일이라도 원통 형태로 인가됩니다.  
( 다각 코일의 경우 약간의 차이가 발생할 수 있음 )

### 나. 파트 수 제한

- 동작은 하나의 파트만 지원합니다.
- 하나의 코일만 지원합니다.

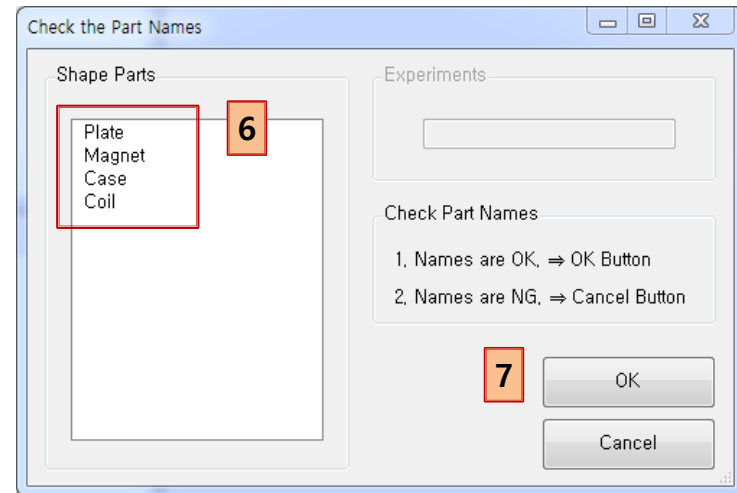
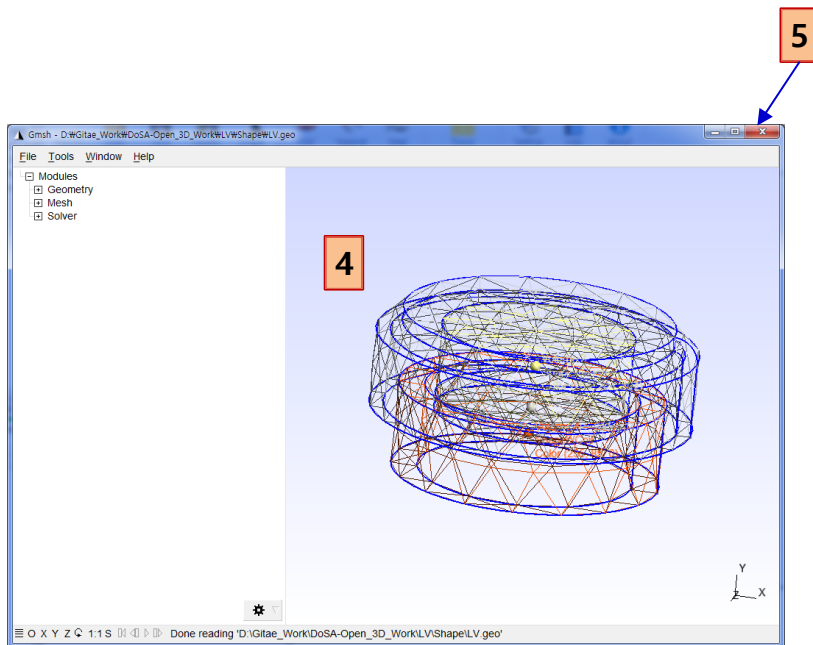
### 다. 형상작업 가이드

- [https://solenoid.or.kr/data/Drawing\\_Guide\\_KOR.pdf](https://solenoid.or.kr/data/Drawing_Guide_KOR.pdf)



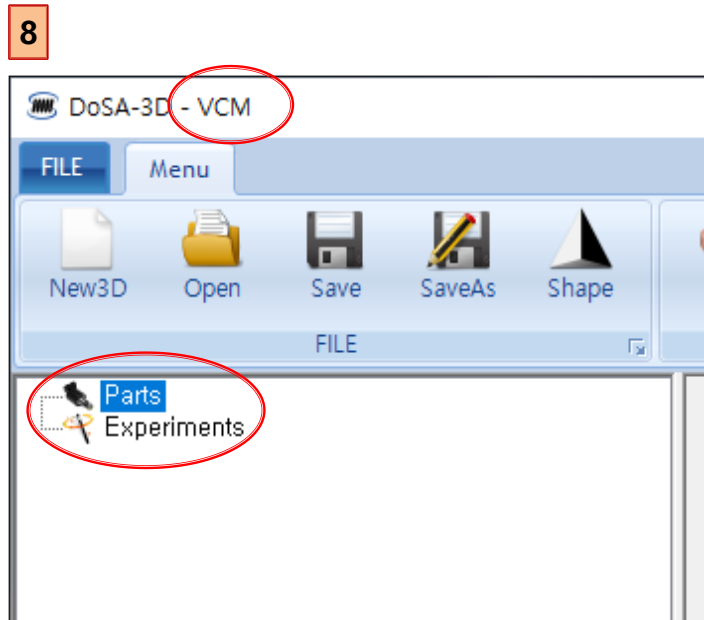
# Design 생성

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

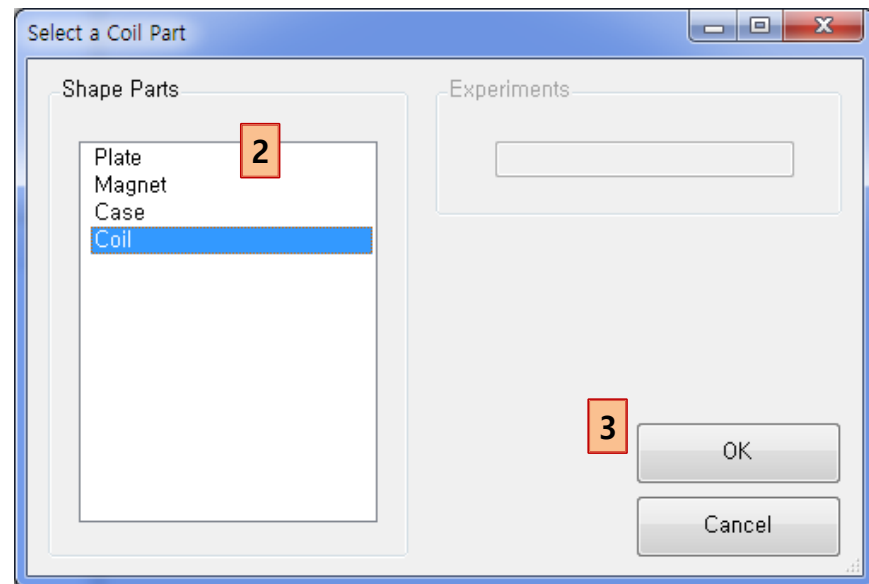
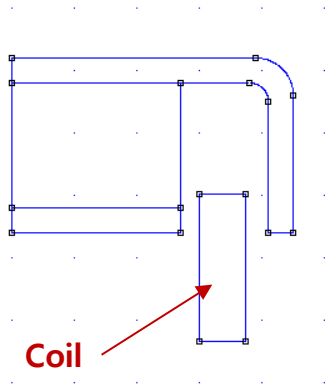
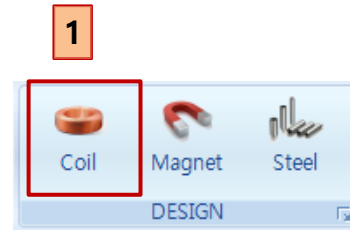
8. Design 생성을 확인한다.



# 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

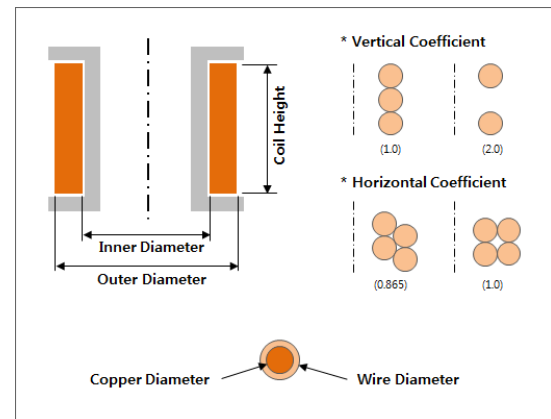
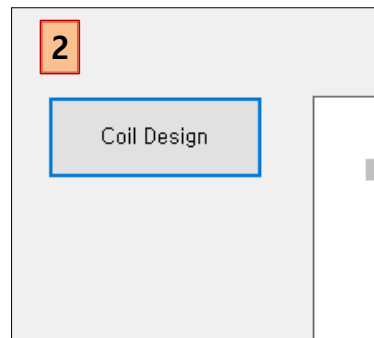
- ✓ Moving Parts : **MOVING**
- ✓ Coil Wire Grade : Bonded\_IEC\_Grade\_1B
- ✓ Inner Diameter : 3
- ✓ Outer Diameter : 3.73
- ✓ Coil Height : 1.18
- ✓ Copper Diameter : 0.045
- ✓ Horizontal Coefficient : 0.95 (Bonded Type)
- ✓ Vertical Coefficient : 1.13 (Bonded Type)
- ✓ Resistance Coefficient : 1.1 (Bonded Type)

## 2. Coil 사양 계산

- ✓ Design Coil 버튼 클릭

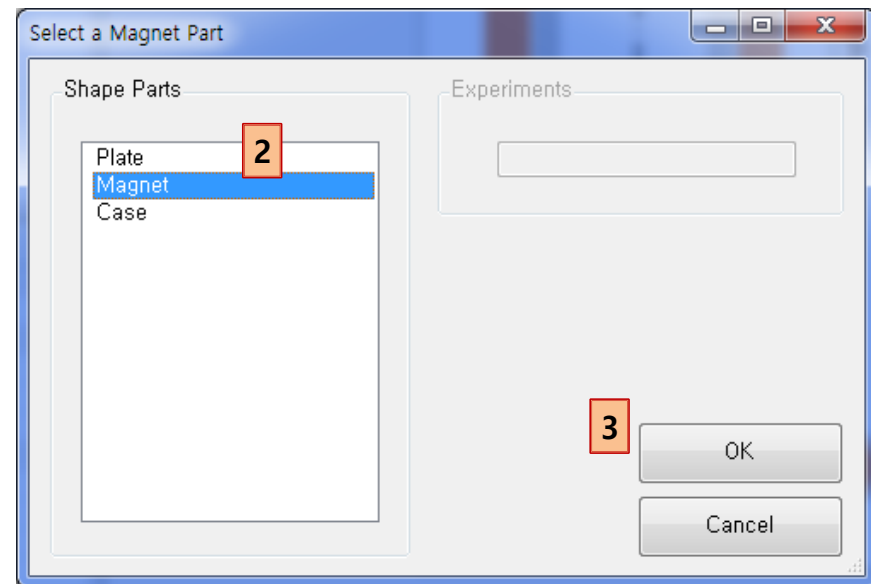
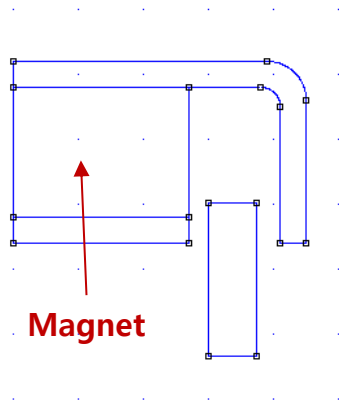
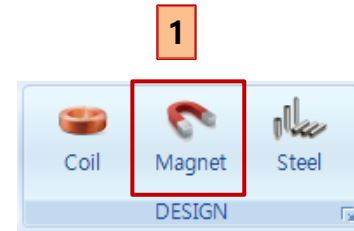
## 3. Coil 사양 확인

Common Fields	
Node Name	Coil
Specification Fields	
Part Material	Copper
Curent Direction	IN
Moving Parts	MOVING
Calculated Fields	
Coil Turns	126
Coil Resistance [ $\Omega$ ]	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



# Magnet 추가

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

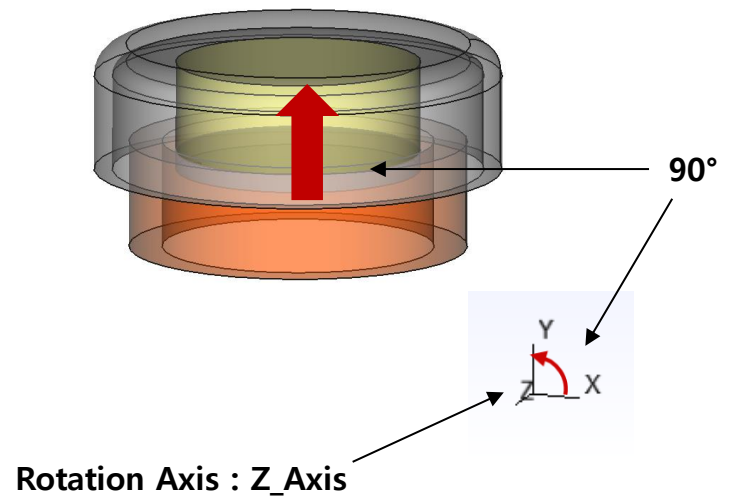


# Magnet 설정

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

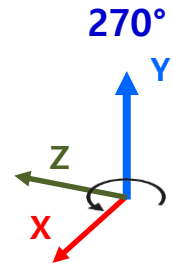
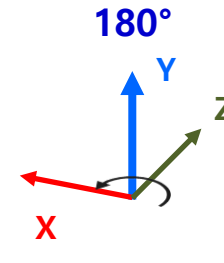
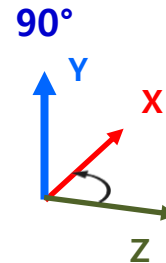
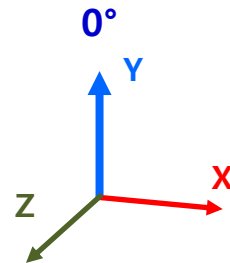
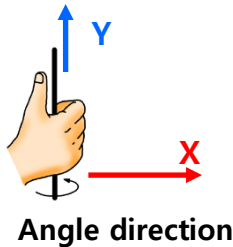
- 영구자석 착자 방향 : **X 축 방향**
- Rotation Axis : X 축의 회전 기준 축
- Rotation Angle : X 축이 회전하는 각도

### ▼ Magnetization Fields

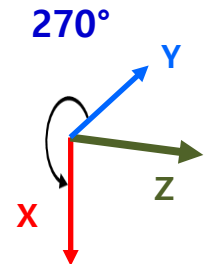
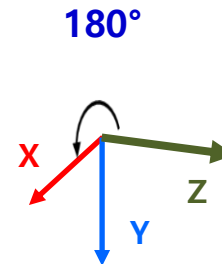
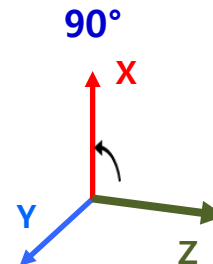
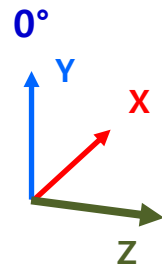
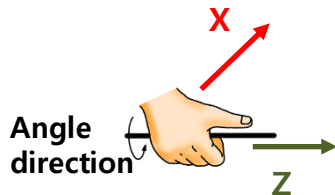
Rotation Axis	Z_AXIS
Rotation Angle	90

## 2. 착자 방향 설정

### ▪ Rotation Axis : Y\_Axis

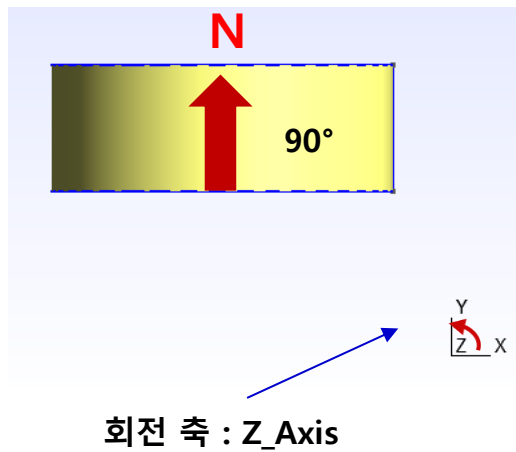


### ▪ Rotation Axis : Z\_Axis

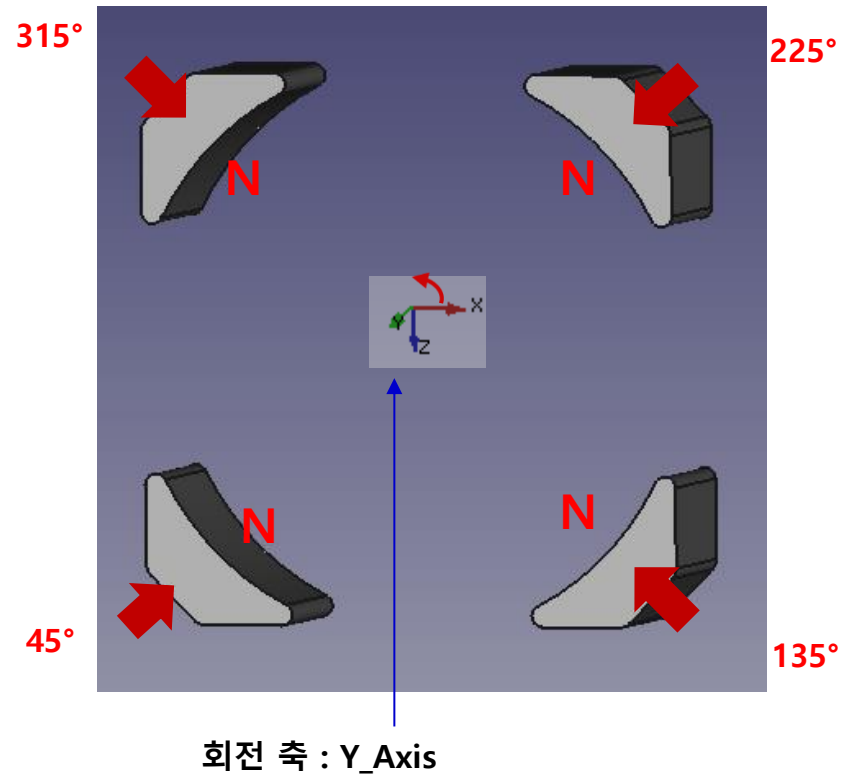


# [참고] 영구자석 착자 사례

- ✓ Rotation Axis : Z\_Axis
- ✓ Rotation Angle : 90°

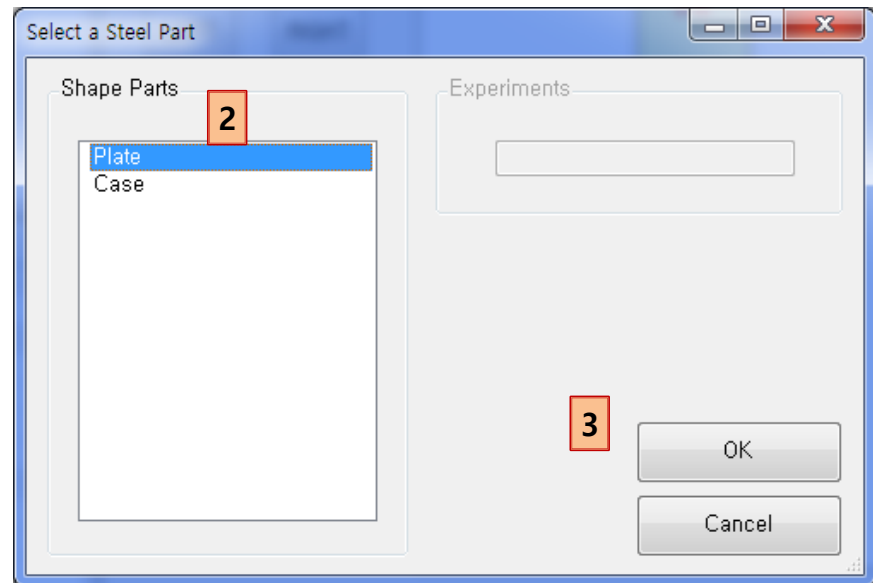
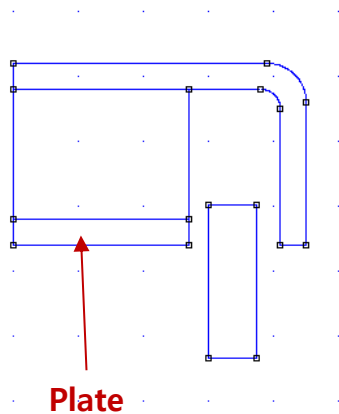


- ✓ Rotation Axis : Y\_Axis
- ✓ Rotation Angle : 45°, 135°, 225°, 315°



# Plate 추가

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

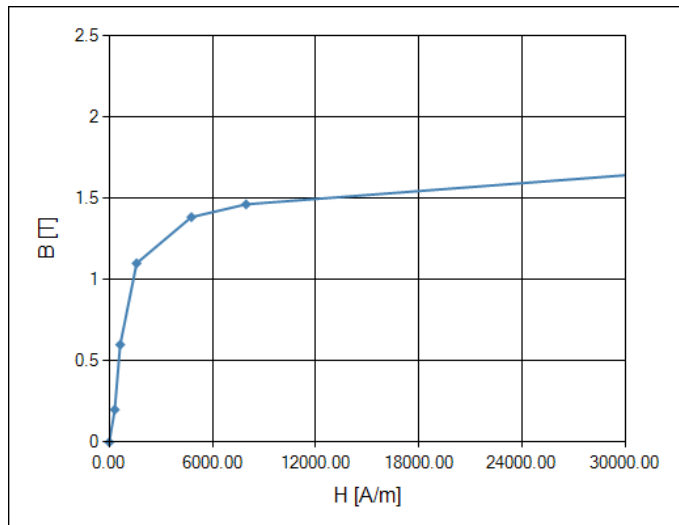


# Plate 설정

## 1. Plate 속성 설정

- ✓ Part Material : SUS\_430 선택

[ BH 곡선 ]

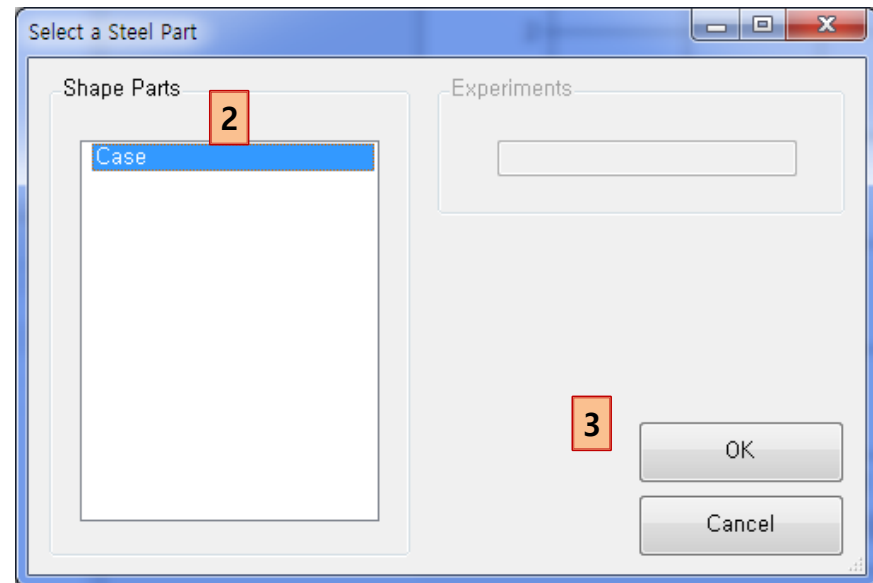
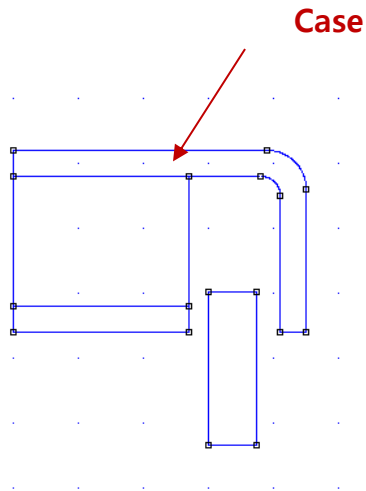
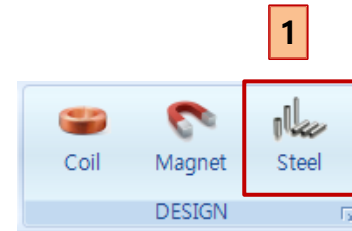


1

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

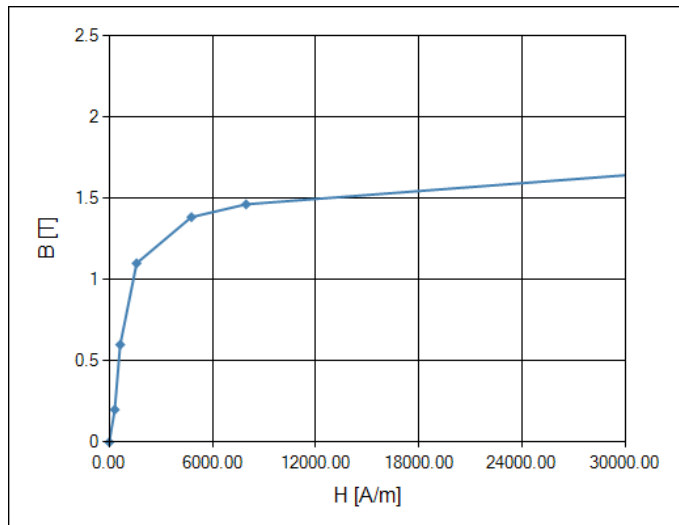


# Case 설정

## 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

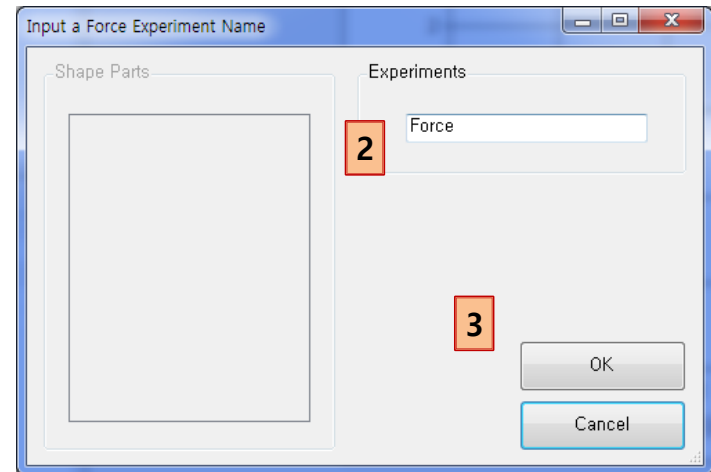
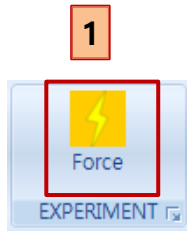
2. Test Name : "Force"

3. OK 버튼 클릭

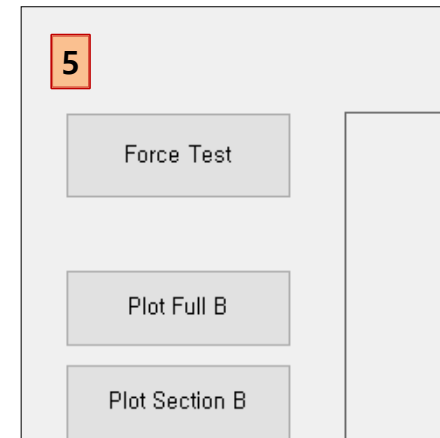
4. 자기력 가상실험 설정

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

5. Force Test 버튼 클릭



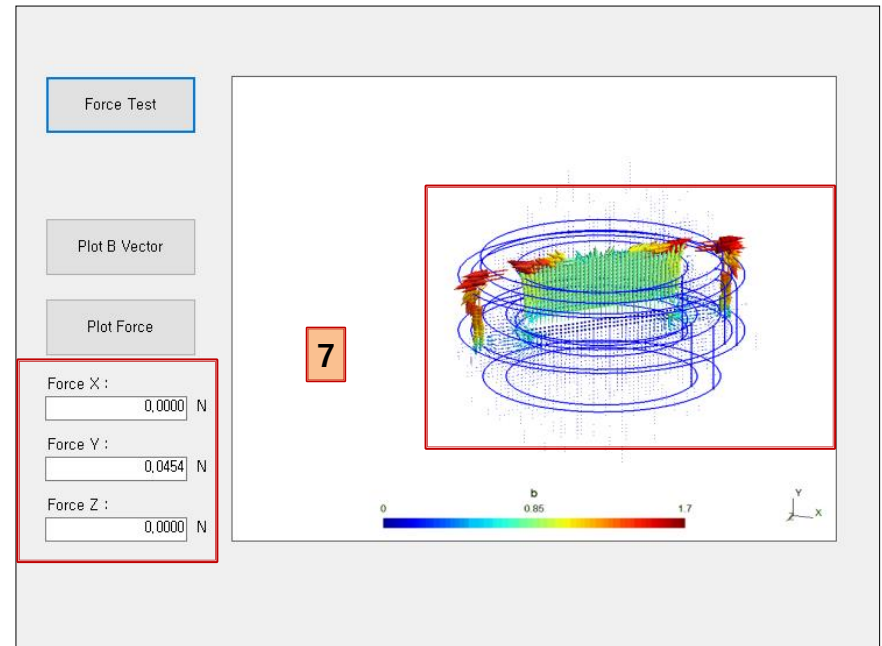
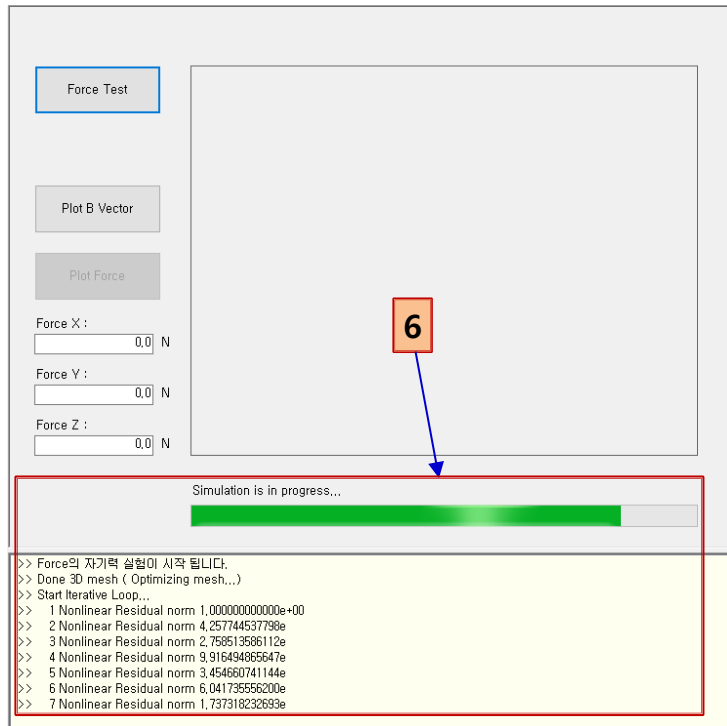
✓ <b>Common Fields</b>	
Node Name	Force
✓ <b>Input Fields</b>	
Voltage [V]	2.5
Max. Current [A]	0.15875
✓ <b>Initial Position Fields</b>	
X Movement [mm]	0
Y Movement [mm]	0
Z Movement [mm]	0
✓ <b>Post-Processing Fields</b>	
B Rotation Angle [°]	45
B Vector Resolution	80
✓ <b>Condition Fields</b>	
Mesh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





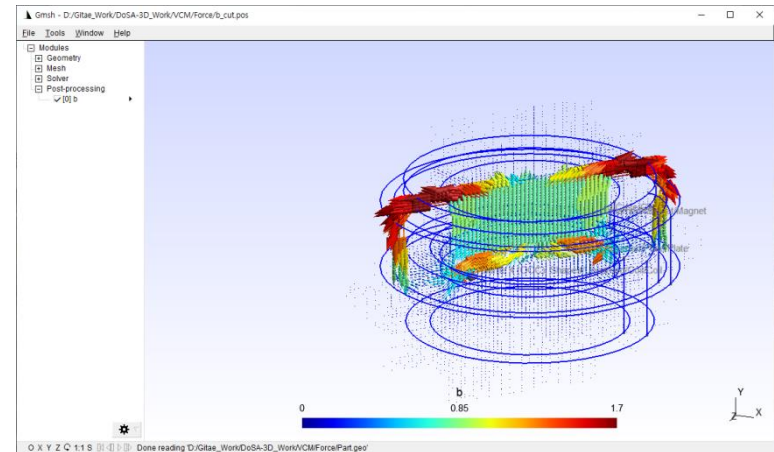
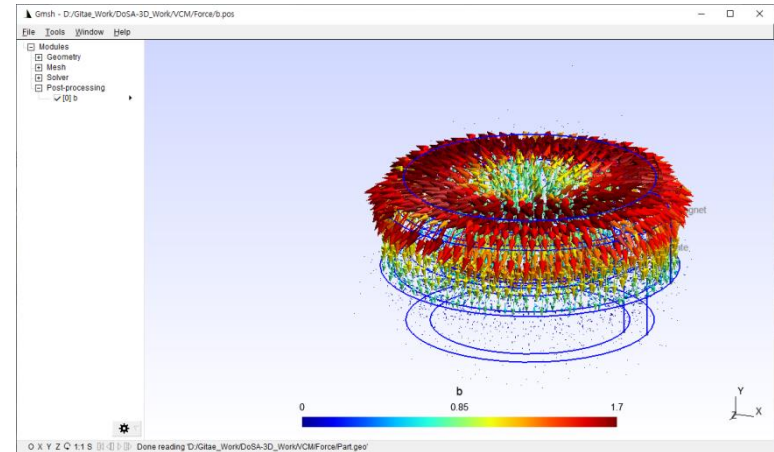
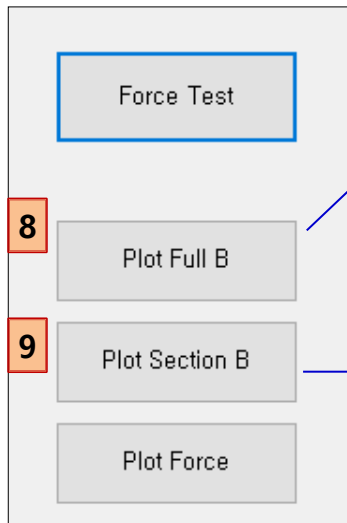
# 자기력 가상실험 실행

6. 자기력 해석 진행 상황을 확인한다.
7. 자기력 및 자속밀도를 확인 한다. ( 해석 시간은 컴퓨터 사양에 따라 다름 )



# 자속밀도 확인

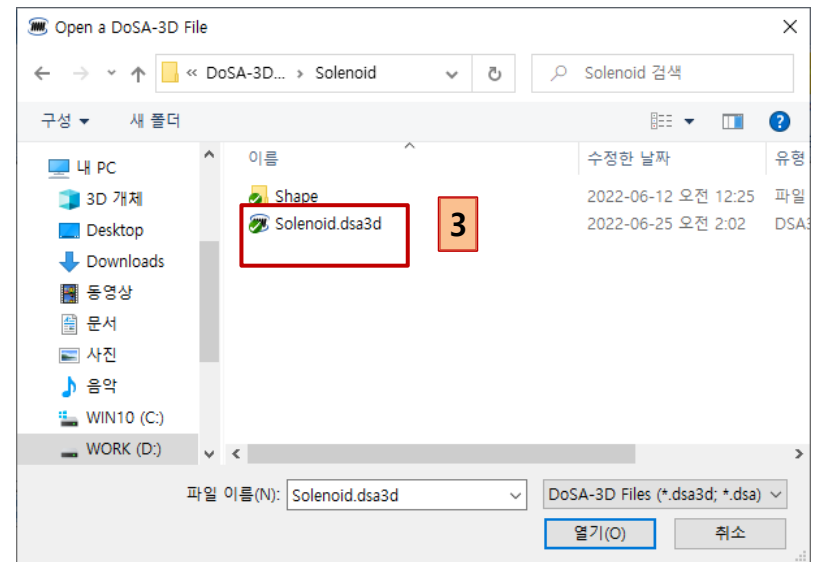
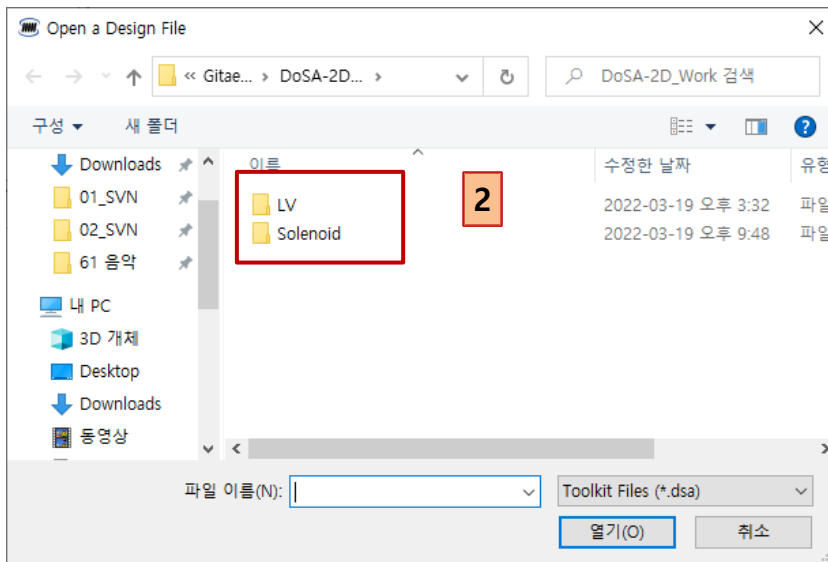
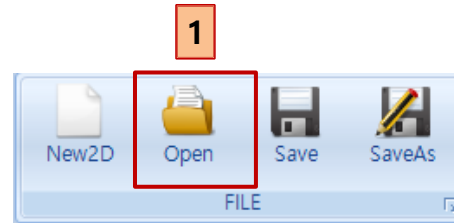
8. 전체 자속밀도를 확인한다.
9. 단면 자속밀도를 확인한다.



# Tips

# Design 열기

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



# 감사합니다

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