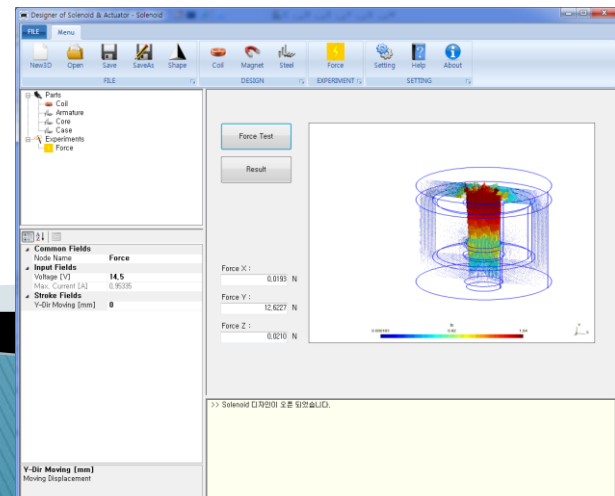


# DoSA-3D 사용 메뉴얼

## Solenoid Example

2022-06-05

zgitae@gmail.com



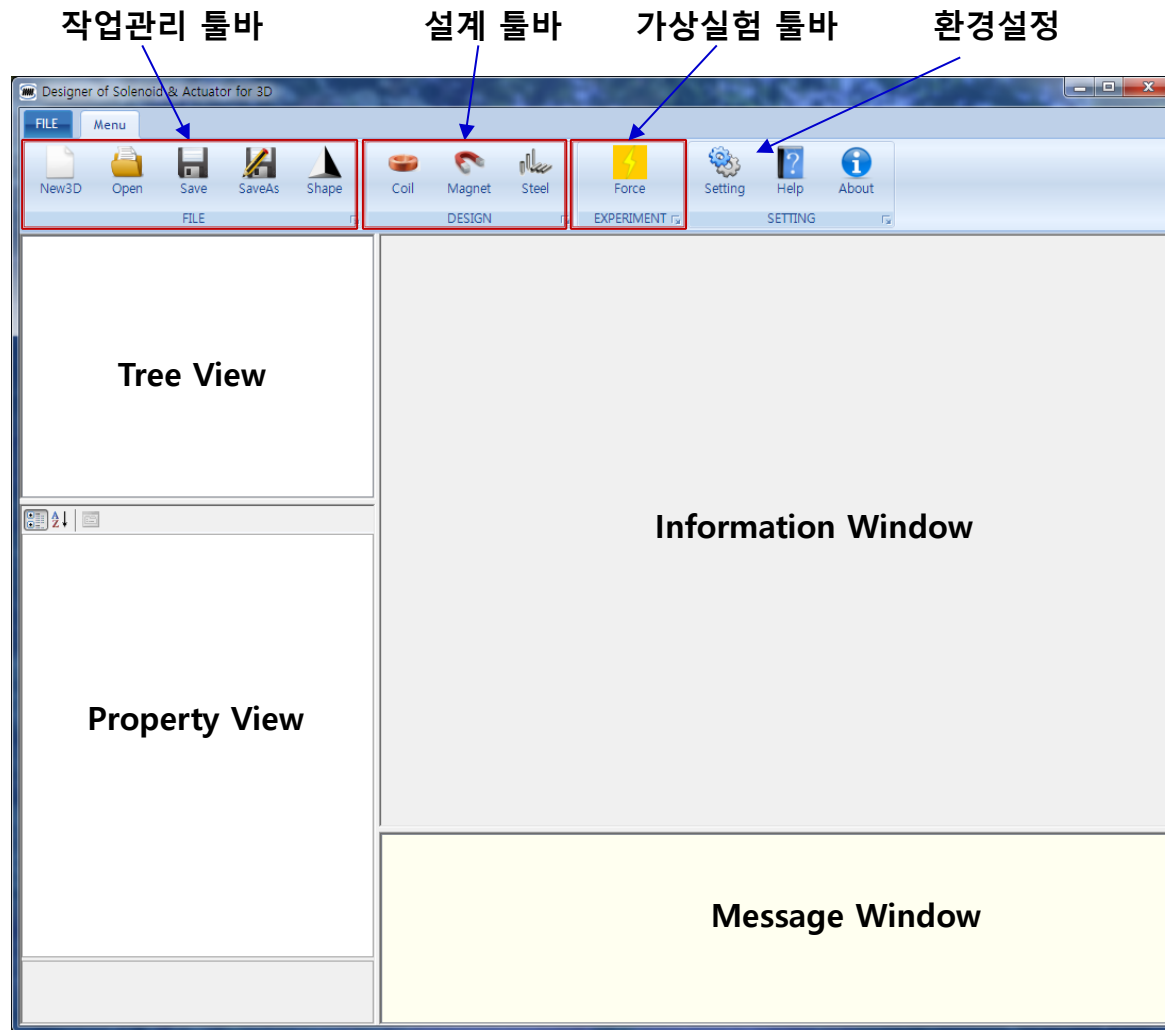
# DoSA 구성

# PC 요구사항

- CPU : 4 Core 이상
- RAM : 16GB 이상



# 프로그램 구성



# Toolbar

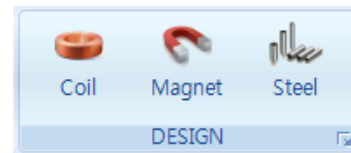
## 1. 작업관리

- ✓ 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 : 자기력 예측



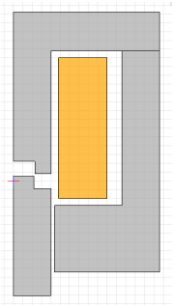
# 작업 흐름

## 제품 설계

## 가상 실험

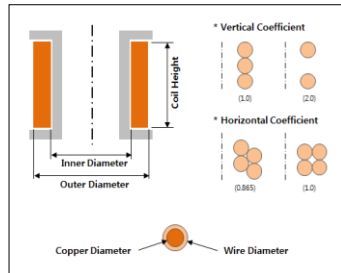
### 1. 형상설계

Geometry



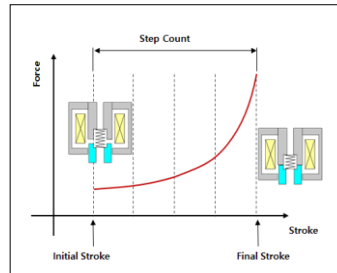
### 2. 부품설계

Components



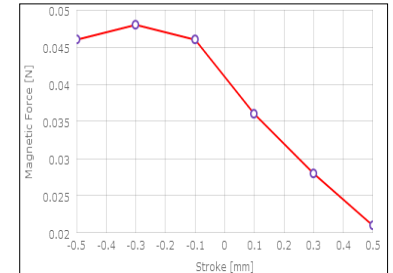
### 3. 시험조건

Test Condition



### 4. 가상실험 (자동실행)

Virtual Test



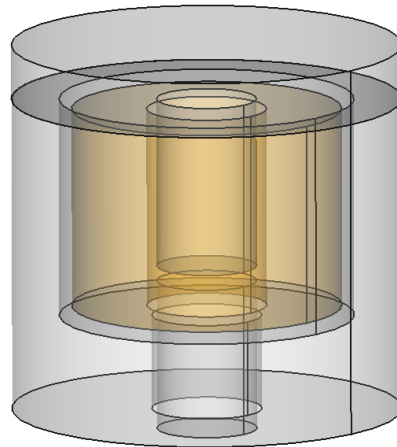
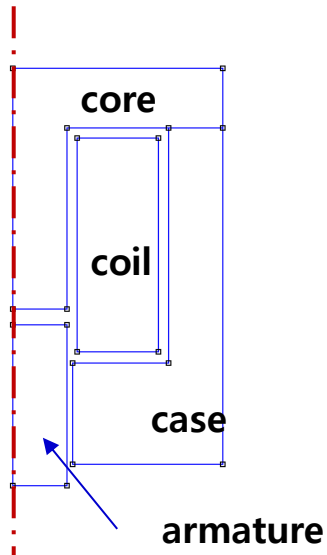
### 5. 결과확인

Results

# 해석 모델

# 해석모델 설명

## 1. 형상 모델



Solenoid.step

## 2. 제품 사양

### 가. 코일권선

- Coil Turns : 1040 turns
- Coil Resistance : 15.2 Ohm

### 나. 전원

- Voltage : 14.5V

( 작업 예제파일 : DoSA-3D 설치 디렉토리 > Samples > Solenoid )



# Design 생성

1. Toolbar > New 버튼 클릭
2. Design Name : 작업 명칭 입력 ( Solenoid )
3. Shape File (STEP) : Solenoid.step 선택 (튜토리얼 문서와 함께 제공됨 )



## [ 형상작업 주의사항 ]

DoSA-3D 는 아직 아래의 기능제한을 가지고 있음

### 가. 형상 제한

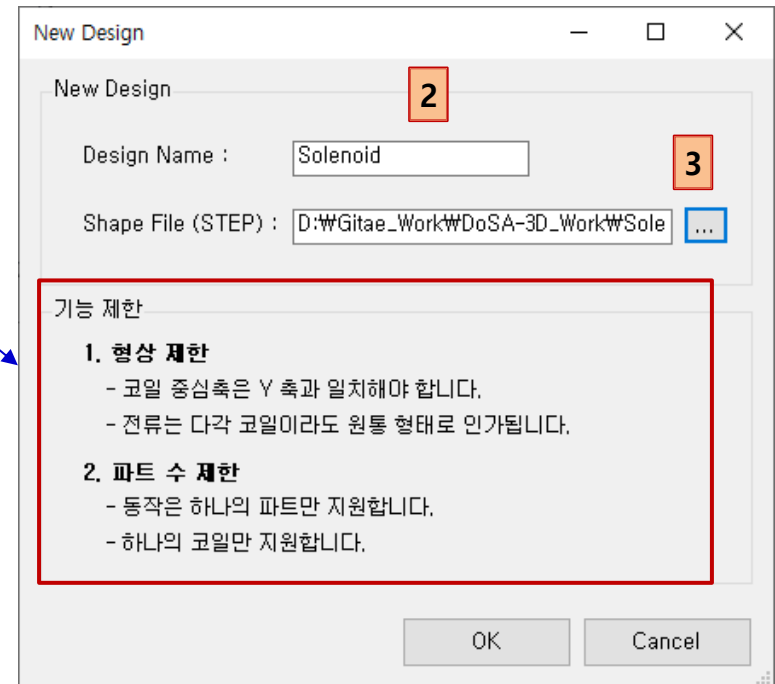
- 코일 중심축은 Y 축과 일치해야 합니다.
- 전류는 다각 코일이라도 원통 형태로 인가됩니다.  
( 다각 코일의 경우 약간의 차이가 발생할 수 있음 )

### 나. 파트 수 제한

- 동작은 하나의 파트만 지원합니다.
- 하나의 코일만 지원합니다.

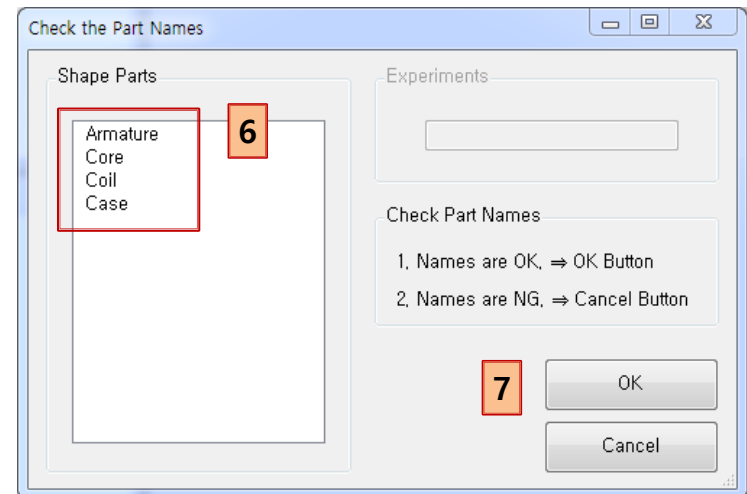
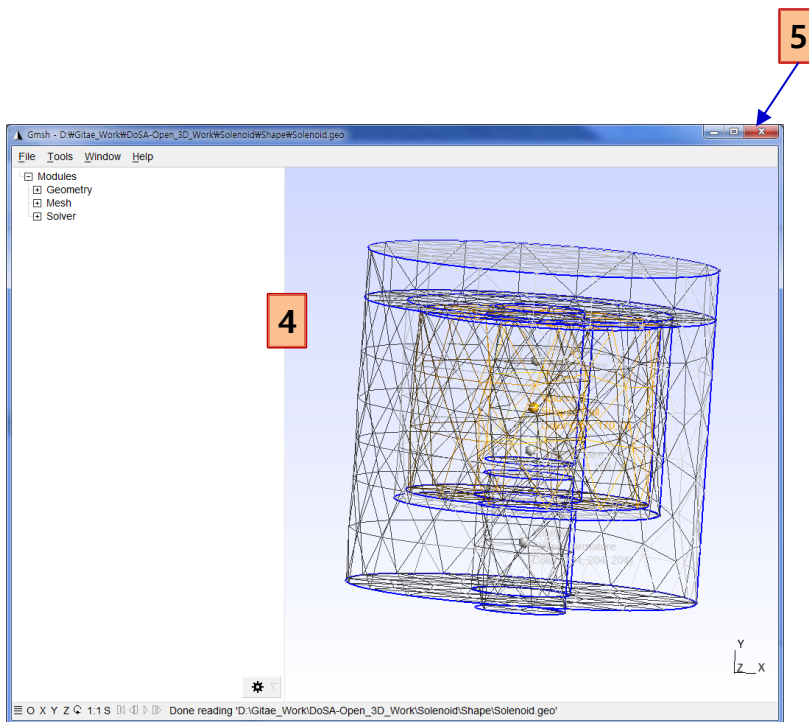
### 다. 형상작업 가이드

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



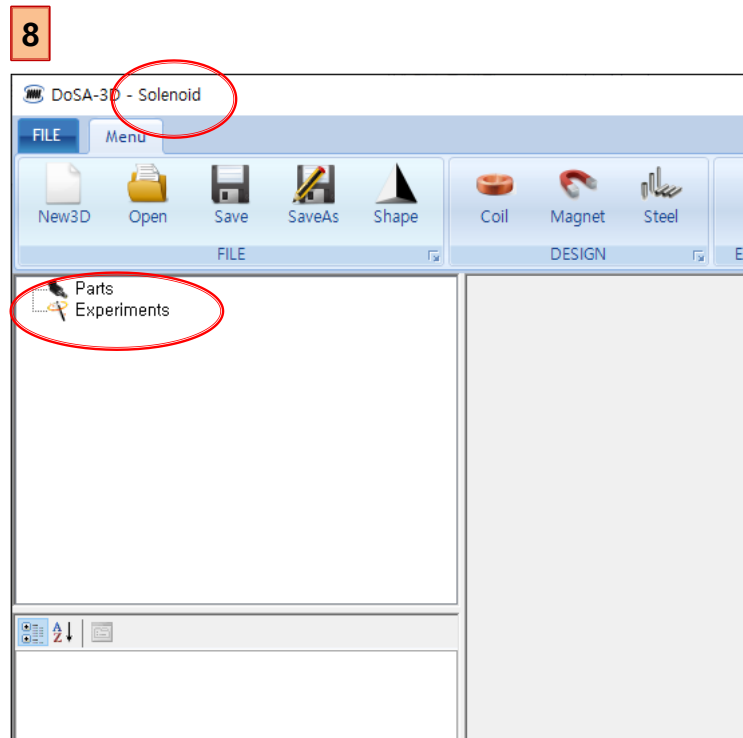
# Design 생성

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

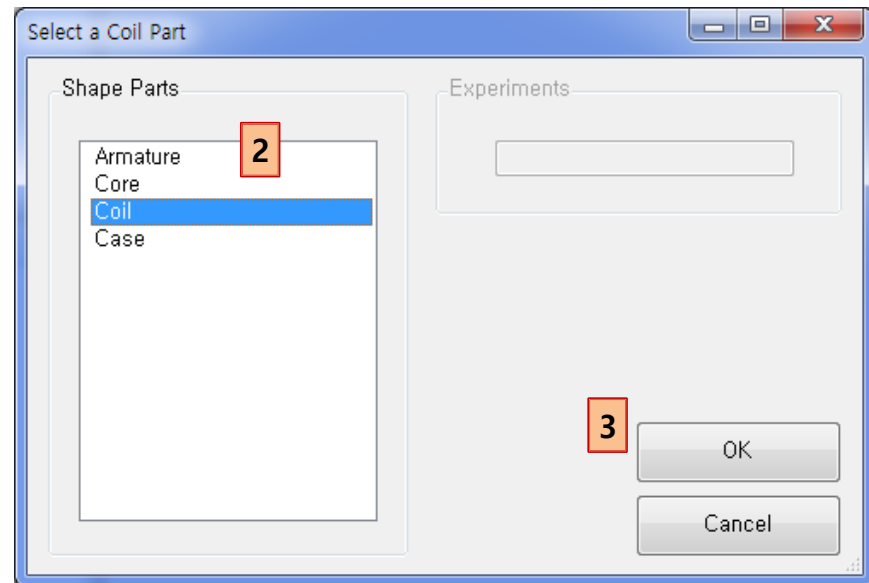
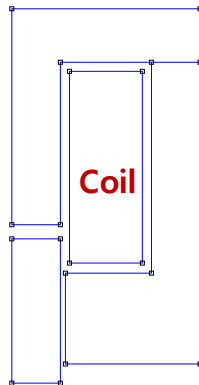
8. Design 생성을 확인한다.



# Parts Design

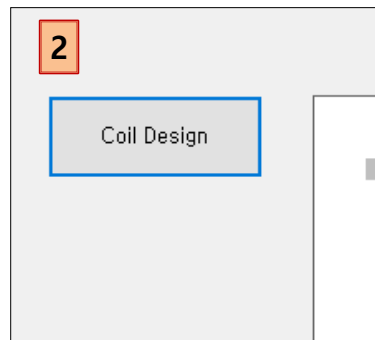
# Coil 추가

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



# Coil 설계

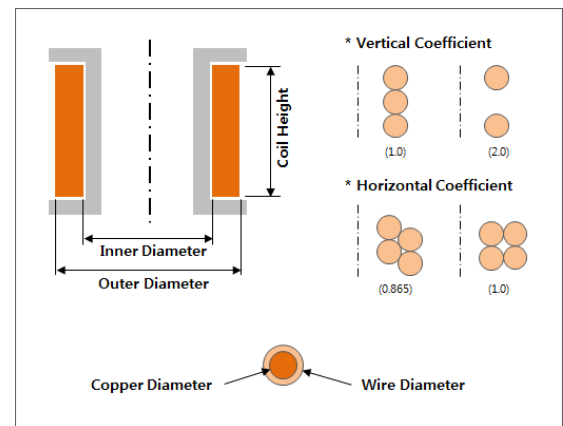
1. Coil 기구사양 입력
  - ✓ Inner Diameter : 9.6
  - ✓ Outer Diameter : 21.6
  - ✓ Coil Height : 16
  - ✓ Copper Diameter : 0.27
2. Coil 사양 계산
  - ✓ Design Coil 버튼 클릭
3. Coil 사양 확인



1

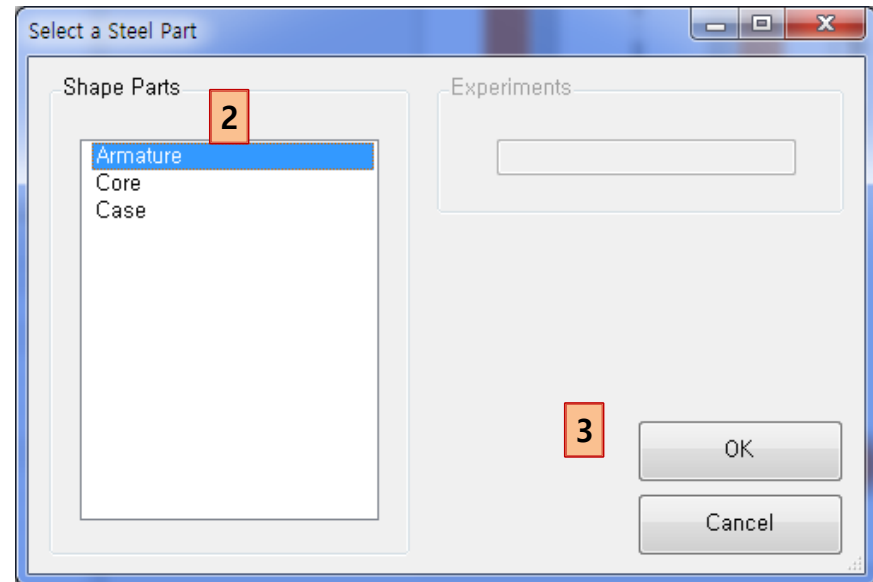
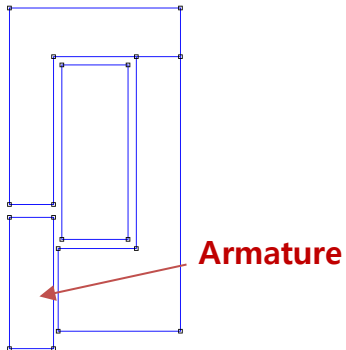
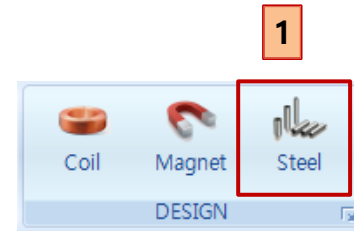
Common Fields	
Node Name	Coil
Specification Fields	
Part Material	Copper
Curent Direction	IN
Moving Parts	FIXED
Calculated Fields	
Coil Turns	1040
Coil Resistance [ $\Omega$ ]	15,20945
Coil Layers	20
Turns of One Layer	52
Design Fields (optional)	
Coil Wire Grade	Enameled_IEC_Grade_2
Inner Diameter [mm]	9.6
Outer Diameter [mm]	21.6
Coil Height [mm]	16
Copper Diameter [mm]	0.27
Wire Diameter [mm]	0.31072
Coil Temperature [ $^{\circ}\text{C}$ ]	20
Horizontal Coefficient	0.9
Vertical Coefficient	0.98
Resistance Coefficient	1

3



# Armature 추가

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



# Armature 설정

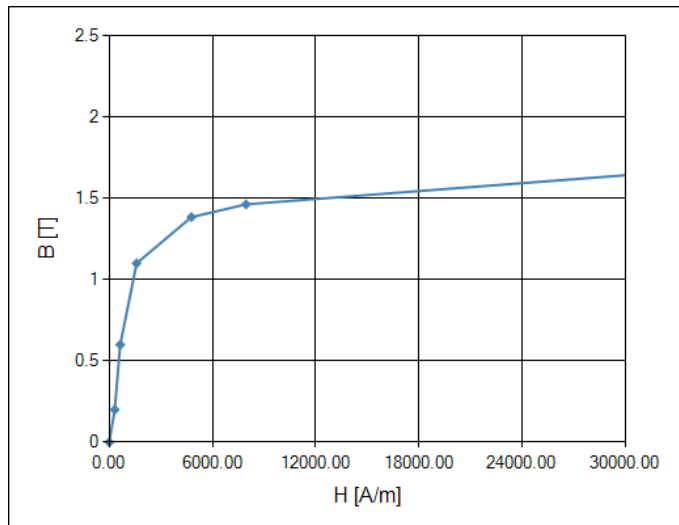
## 1. Armature 속성 설정

✓ Part Material : SUS\_430 선택

✓ Moving Parts : **MOVING**

자기력 계산 파트 선정

[ BH 곡선 ]



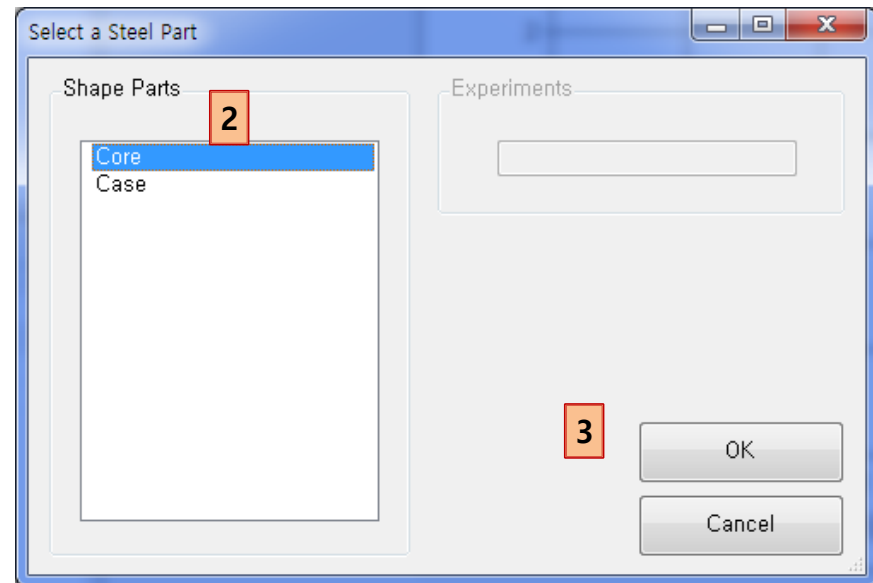
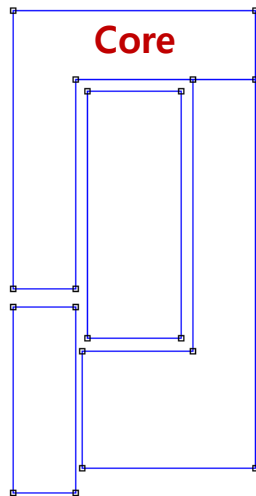
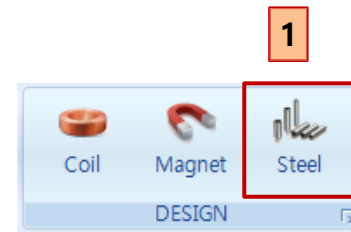
1

Common Fields	
Node Name	Armature
Specification Fields	
Part Material	SUS_430
Moving Parts	MOVING



# Core 추가

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

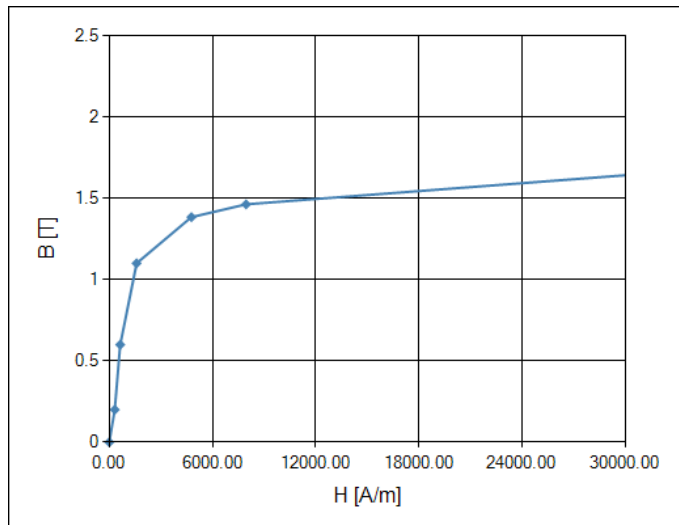


# Core 설정

## 1. Core 속성 설정

- ✓ Part Material : SUS\_430 선택

[ BH 곡선 ]

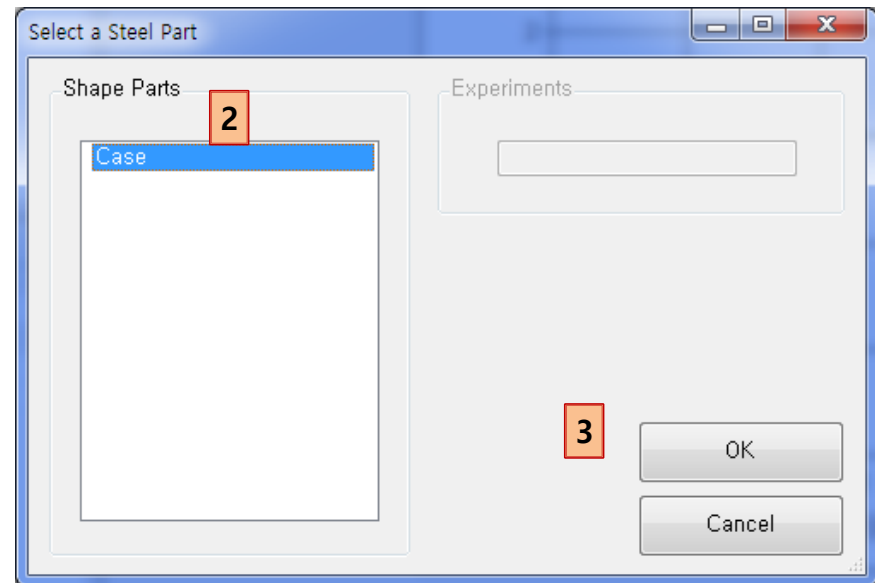
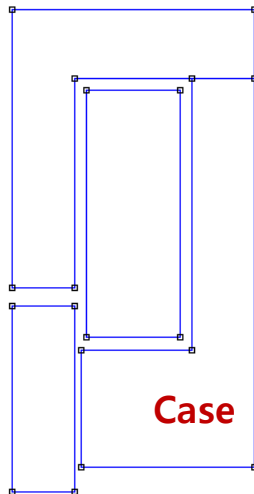
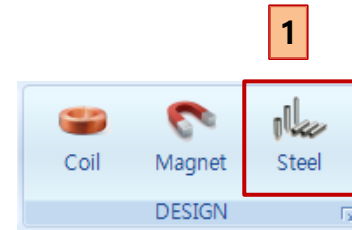


1

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

# Case 생성

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

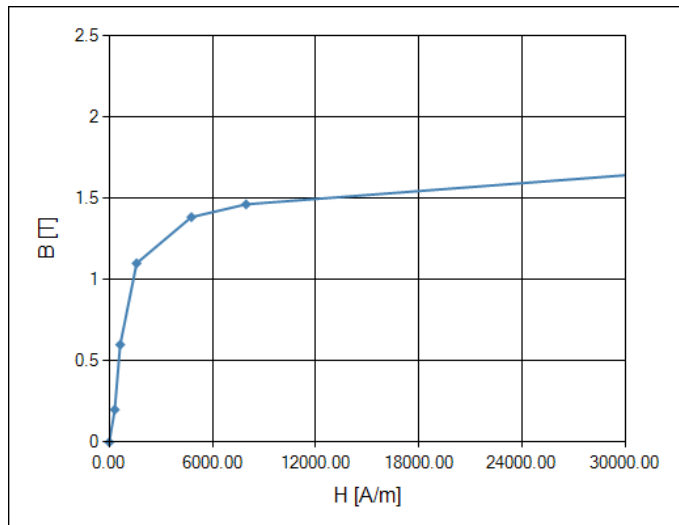


# Case 설정

## 1. Case 속성 설정

✓ Part Material : SUS\_430 선택

[ BH 곡선 ]



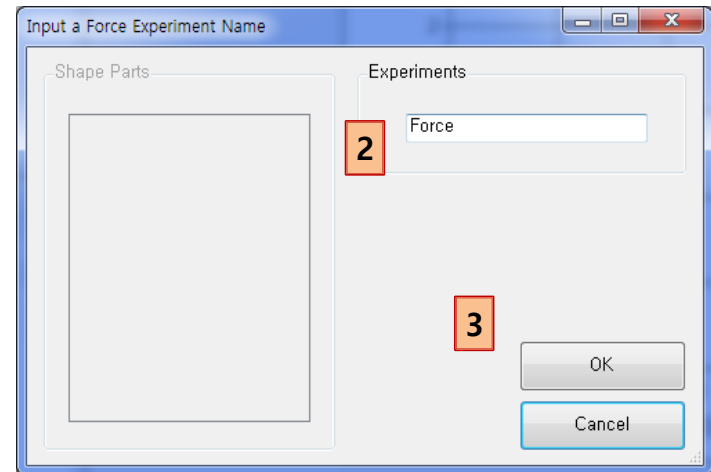
1

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

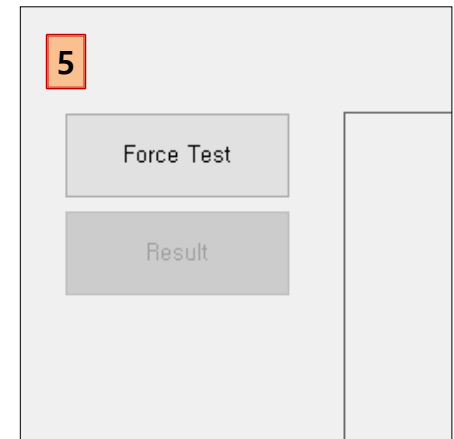
# Virtual Test

# 자기력 가상실험

1. Toolbar > Force 버튼 클릭
2. Test Name : "force"
3. OK 버튼 클릭
4. 자기력 가상실험 설정
  - ✓ Voltage : 14.5
  - ✓ B Rotation Angle : 45
  - ✓ Mesh Size Percent : 7
  - ✓ Actuator Type : Solenoid
5. Force Test 버튼 클릭

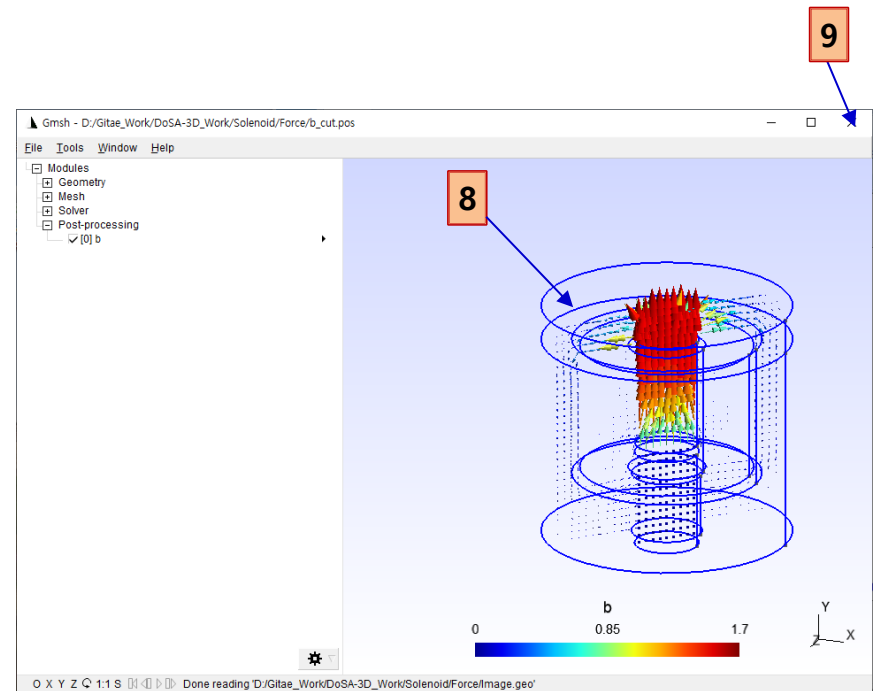
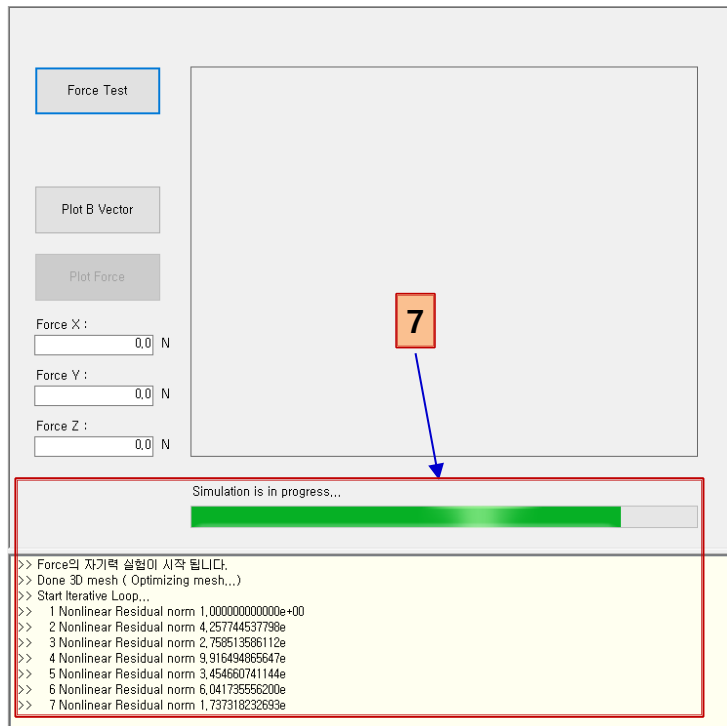


▼ Common Fields	
Node Name	Force
▼ Input Fields	
Voltage [V]	14.5
Max. Current [A]	0.95335
▼ Initial Position Fields	
Y Movement [mm]	0
X Movement [mm]	0
Z Movement [mm]	0
▼ Post-Processing Fields	
B Rotation Angle [°]	45
B Vector Resolution	50
▼ Condition Fields	
Mesh Size [%]	7
Actuator Type	Solenoid



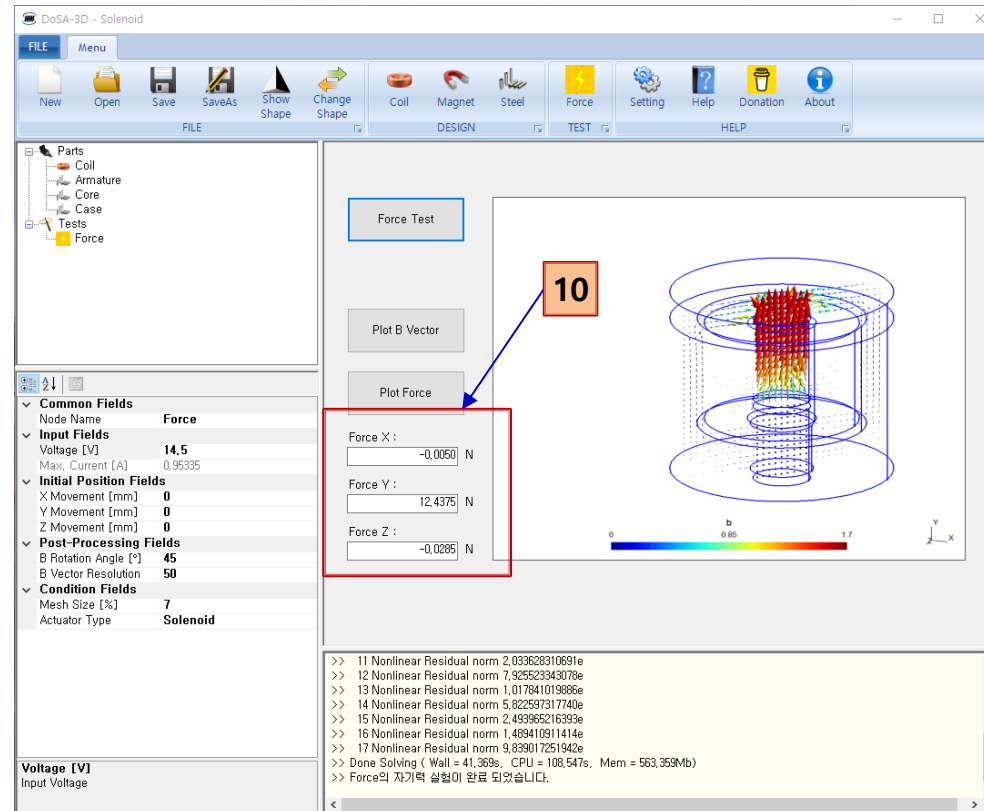
# 자기력 가상실험 실행

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



# 자기력 가상실험 결과

10. DoSA-3D 안에서 자기력을 확인한다.

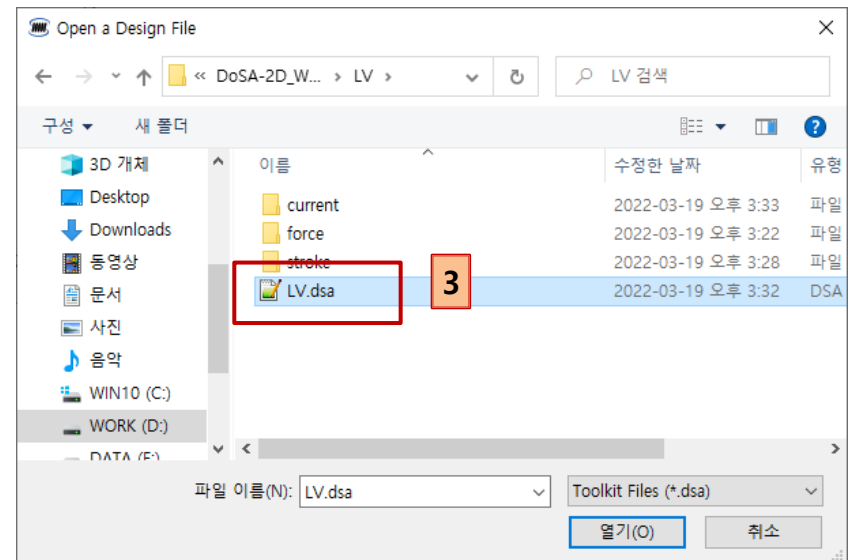
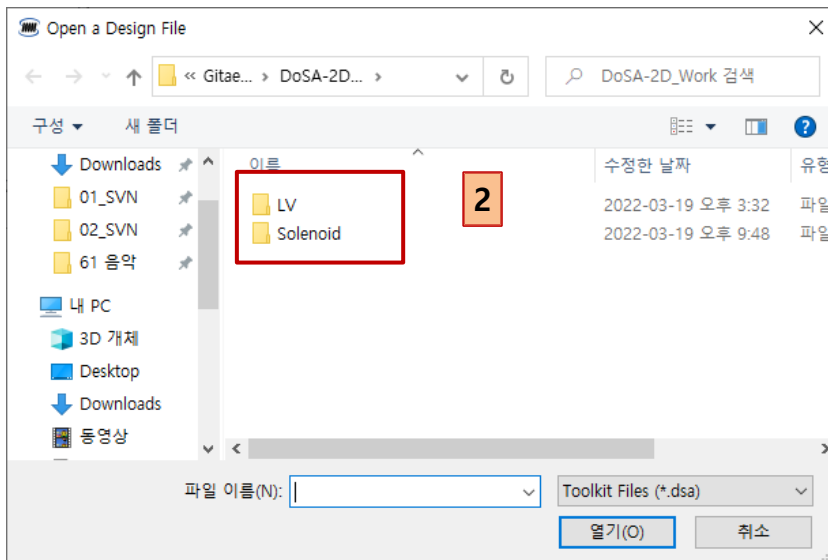
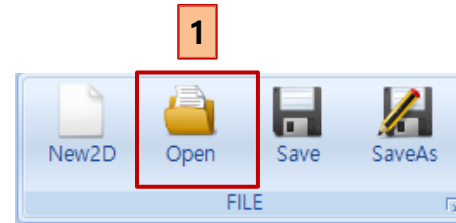




# Tips

# Design 열기

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



# Thank You

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