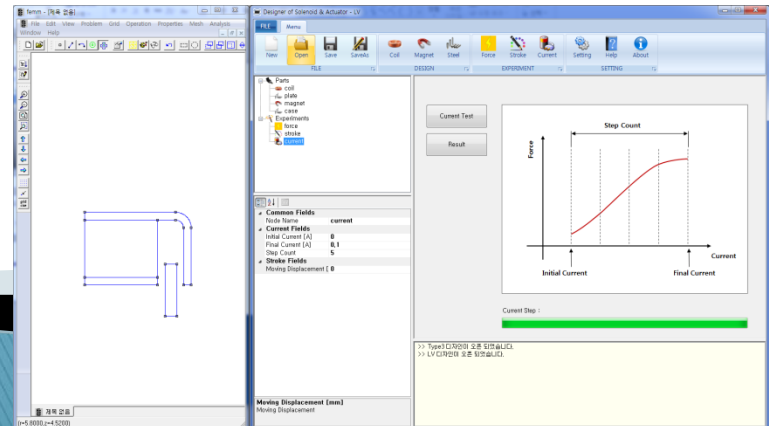


DoSA-2D 사용 메뉴얼

Solenoid Example

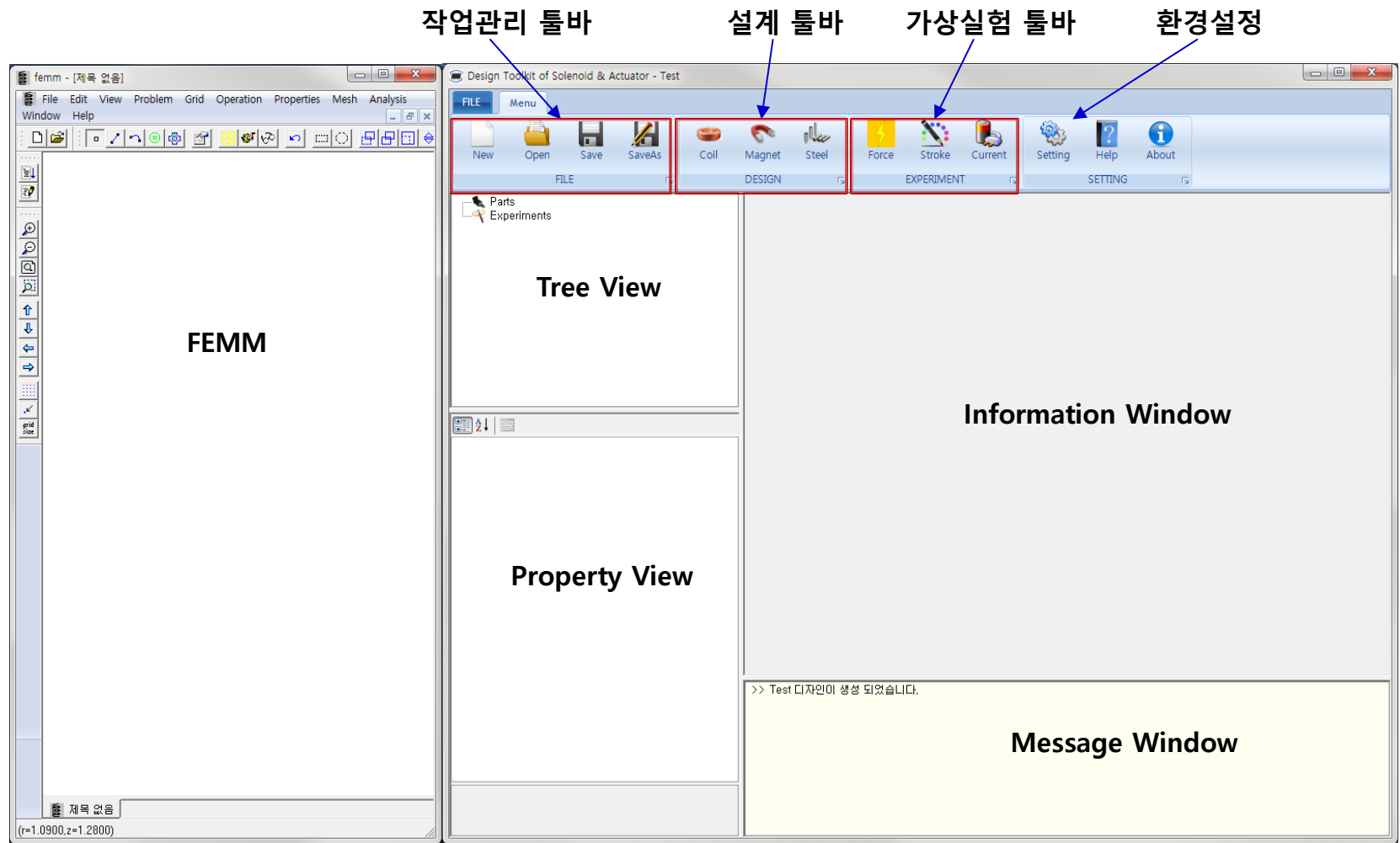
2022-03-19

GiTae Kweon (zgitae@gmail.com)



DoSA 구성

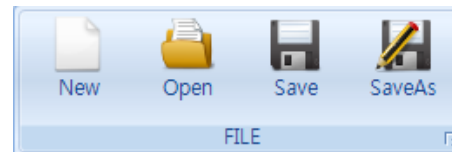
프로그램 구성



Toolbar

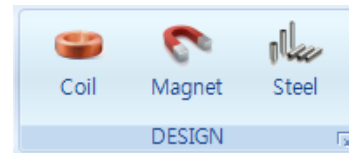
1. 작업관리

- ✓ New : 신규작업 생성
- ✓ Open : 이전작업 열기
- ✓ Save : 작업 저장
- ✓ SaveAs : 다른 이름으로 저장



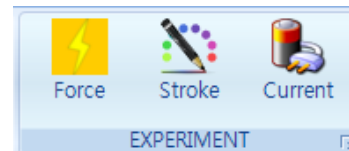
2. 설계

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



3. 가상실험

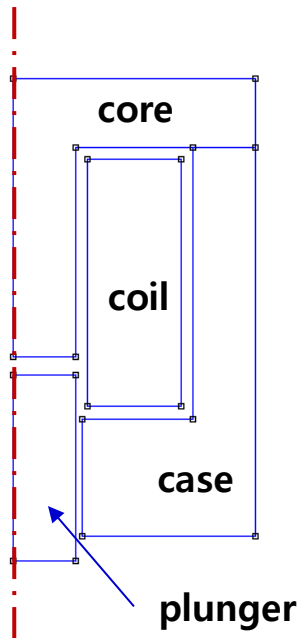
- ✓ Force : 자기력 예측
- ✓ Stroke : 변위별 자기력 예측
- ✓ Current : 전류별 자기력 예측



해석 모델

해석모델 설명

1. 형상 모델



2. 제품 사양

가. 코일권선

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

나. 전원

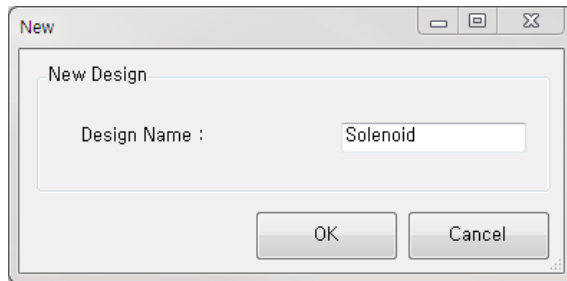
- Voltage : 14.5V

(작업 예제파일 : DoSA-2D 설치 디렉토리 > Samples > Solenoid)

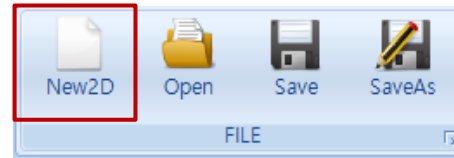
Design 생성

1. Toolbar > New 버튼 클릭
2. Design Name : "Solenoid"
3. OK 클릭

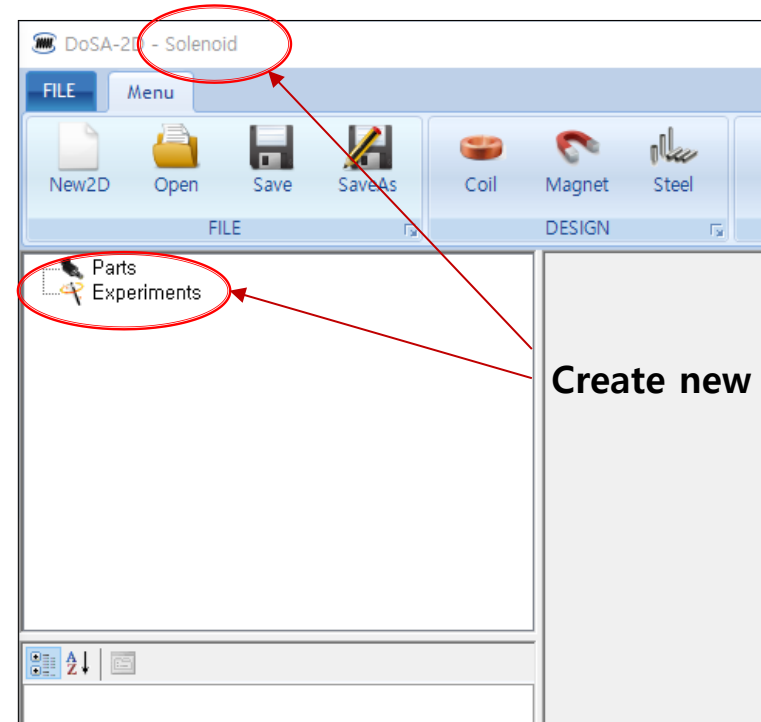
2



1



3

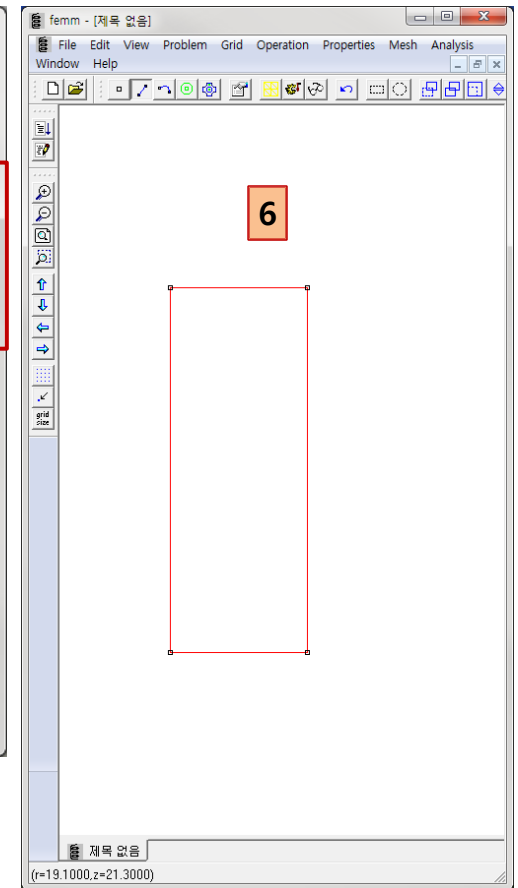
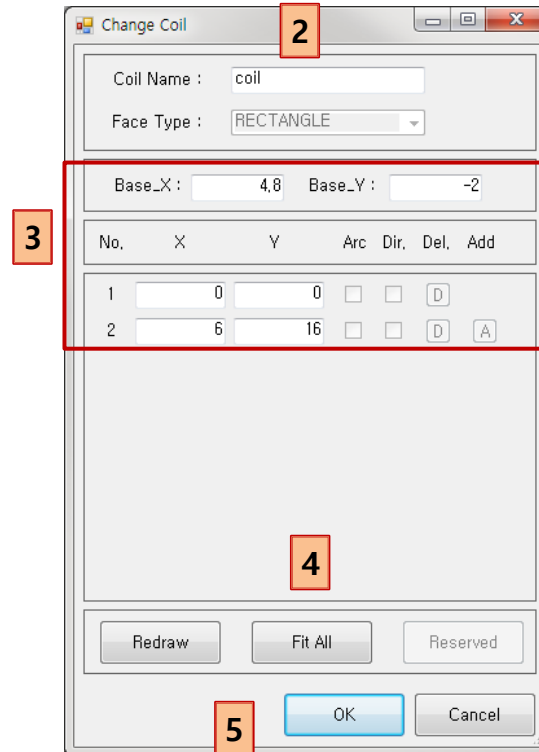
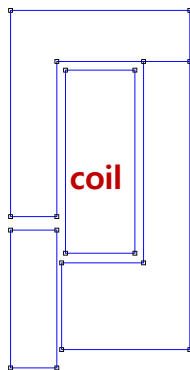


Create new design

Parts Design

Coil 생성

1. Toolbar > Coil 버튼 클릭
2. Coil Name 입력 : "coil"
3. Coil 형상 입력
 - ✓ 코일 위치 : Base_X 4.8, Base_Y -2
 - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
 - ✓ 우상 점 : X 6, Y 16 (상대 좌표)
4. 화면 조정 : Fit All 버튼 사용
5. OK 버튼 클릭
6. 형상 확인 (FEMM 창)



Coil 설계

1. Coil 기구사양 입력

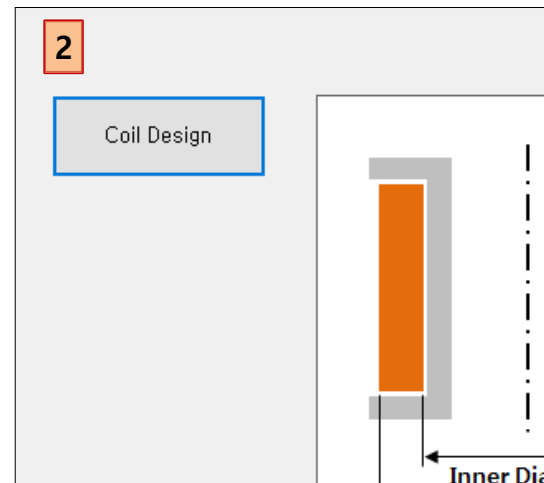
- ✓ Copper Diameter : 0.27
- ✓ Horizontal Coefficient : 기본값
- ✓ Vertical Coefficient : 기본값
- ✓ Resistance Coefficient : 기본값

2. Coil 사양 계산

- ✓ Design Coil 버튼 클릭

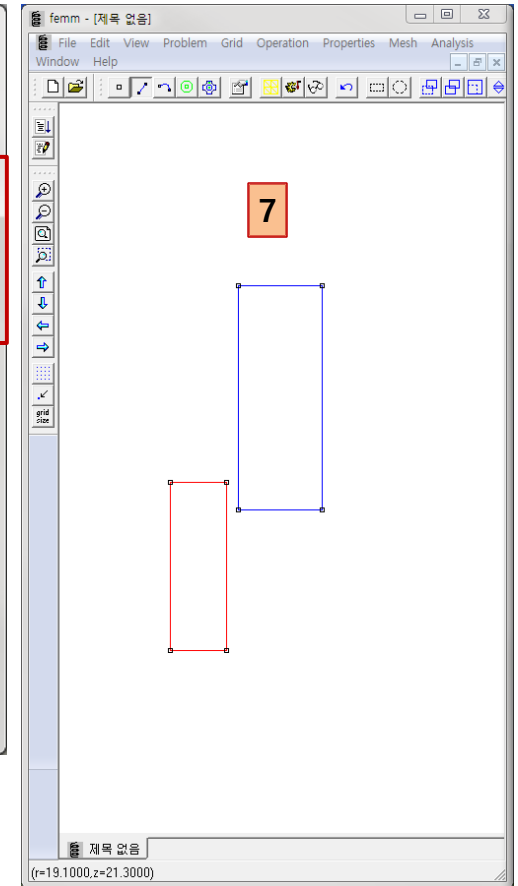
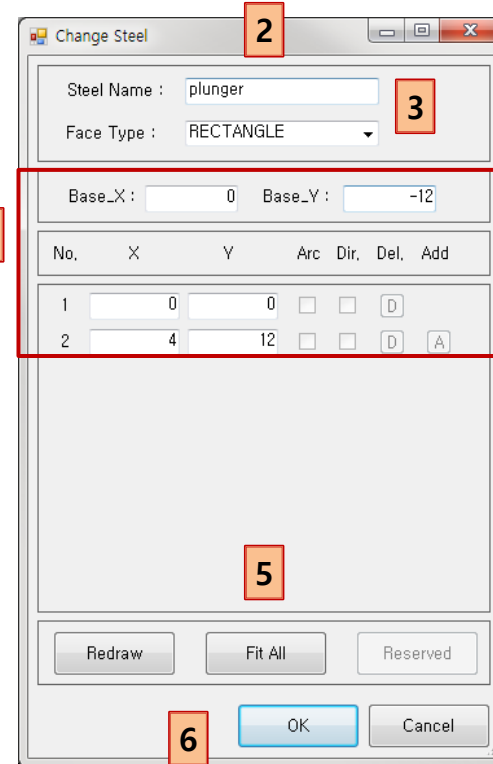
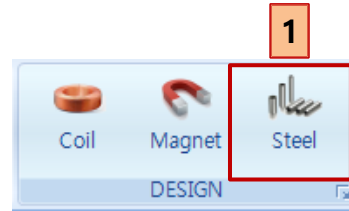
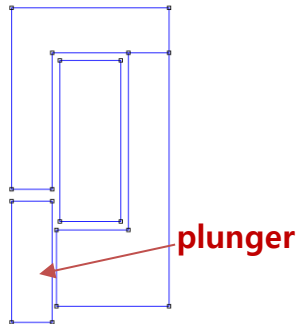
3. Coil 사양 확인

Common Fields	
Node Name	coil
Specification Fields	
Part Material	Copper
Current Direction	IN
Moving Parts	FIXED
Calculated Fields	
Coil Turns	1040
Coil Resistance [Ω]	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



Plunger 생성

1. Toolbar > Steel 버튼 클릭
2. Steel Name : "plunger"
3. Face Type : **RECTANGLE**
4. Plunger 형상 입력
 - ✓ Plunger 위치 : Base_X 0, Base_Y -12
 - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
 - ✓ 우상 점 : X 4, Y 12 (상대 좌표)
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭
7. 형상 확인 (FEMM 창)

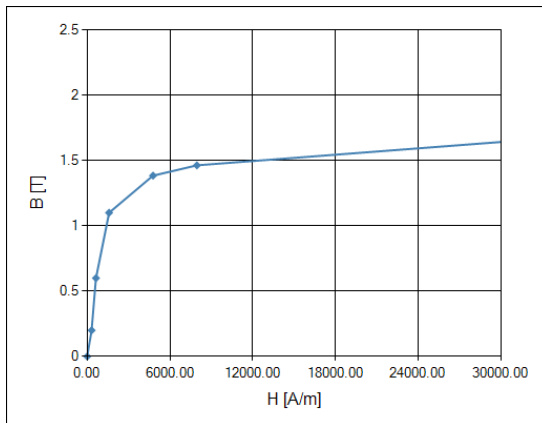


Plunger 설정

8. Plunger 속성 설정

- ✓ Part Material : 430 Stainless Steel 선택
- ✓ Moving Parts : **MOVING**

[BH curve]

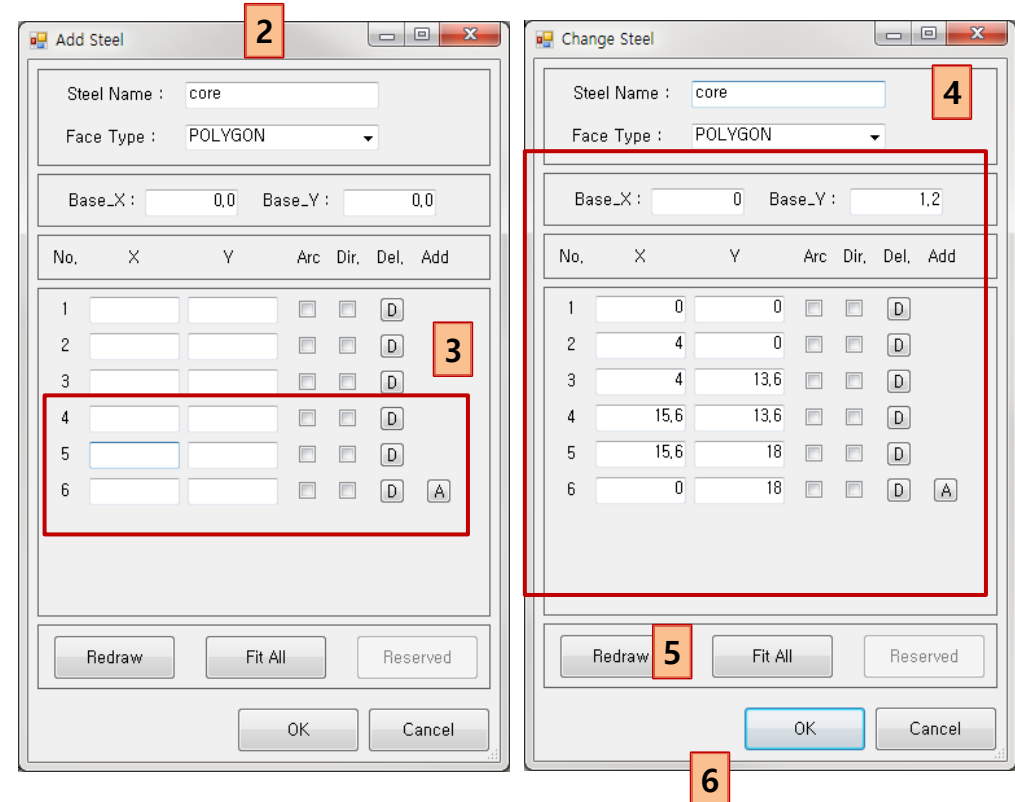


8

Common Fields	
Node Name	plunger
Specification Fields	
Part Material	430 Stainless Steel
Moving Parts	MOVING

Core 생성

1. Toolbar > Steel 버튼 클릭
2. Steel Name 입력 : "core"
3. 좌표 입력라인 추가
✓ 'A' 버튼 2번 클릭
4. Core 형상 입력
✓ Core 위치 : Base_X 0, Base_Y 1.2
✓ 1 점 : X 0, Y 0
✓ 2 점 : X 4, Y 0
✓ 3 점 : X 4, Y 13.6
✓ 4 점 : X 15.6, Y 13.6
✓ 5 점 : X 15.6, Y 18
✓ 6 점 : X 0, Y 18
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭

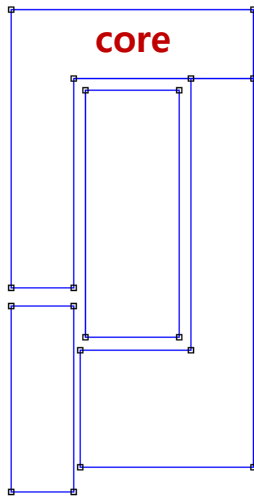


Core 설정

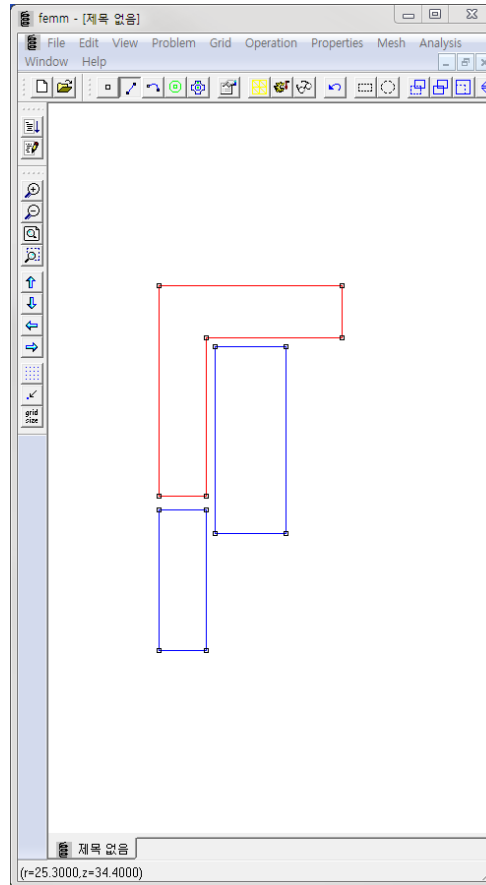
7. 형상 확인 (FEMM 창)

8. Core 속성 설정

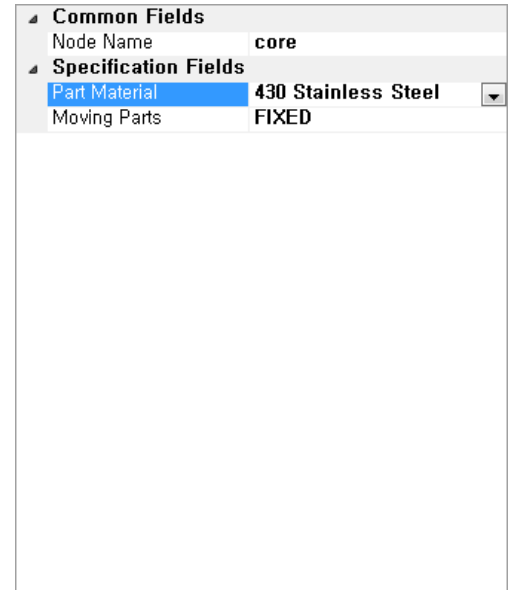
✓ Part Material : 430 Stainless Steel



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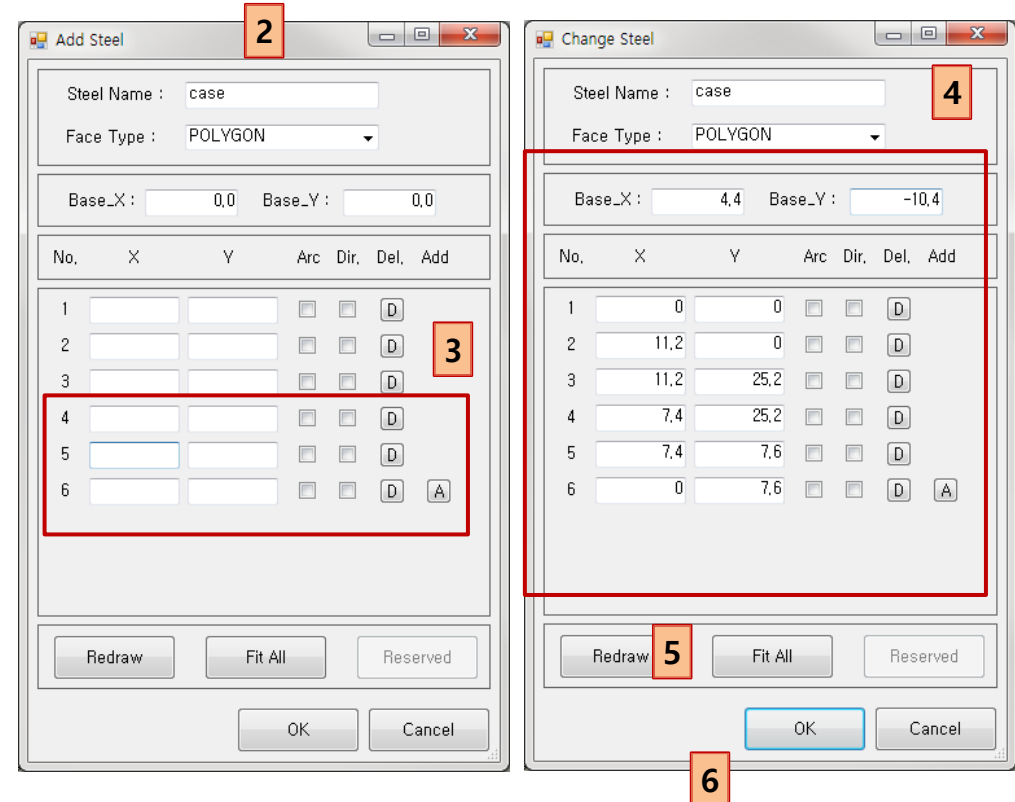
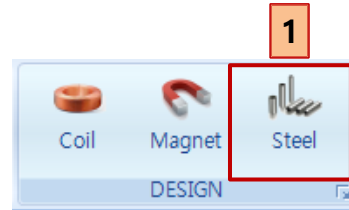


8



Case 생성

1. Toolbar > Steel 버튼 클릭
2. Steel Name : "case"
3. 좌표 입력라인 추가
✓ 'A' 버튼 2번 클릭
4. Case 형상 입력
✓ Case 위치 : Base_X 4.4, Base_Y -10.4
✓ 1 점 : X 0, Y 0
✓ 2 점 : X 11.2, Y 0
✓ 3 점 : X 11.2, Y 25.2
✓ 4 점 : X 7.4, Y 25.2
✓ 5 점 : X 7.4, Y 7.6
✓ 6 점 : X 0, Y 7.6
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭

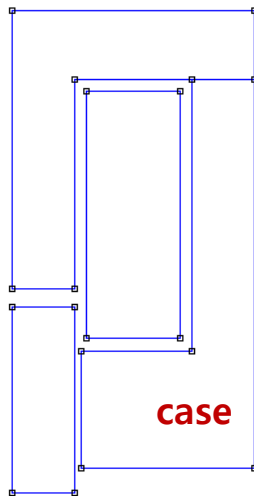


Case 설정

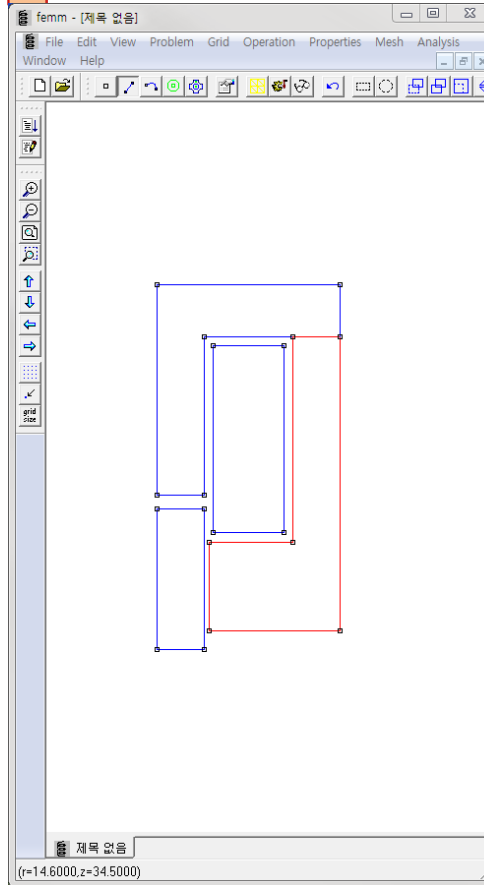
7. 형상 확인 (FEMM 창)

8. Case 속성 설정

✓ Part Material : 1010 Steel



7



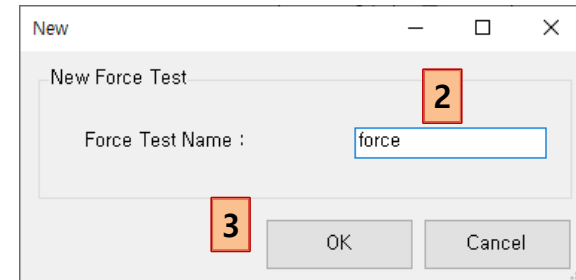
8

Common Fields	
Node Name	case
Specification Fields	
Part Material	1010 Steel
Moving Parts	FIXED

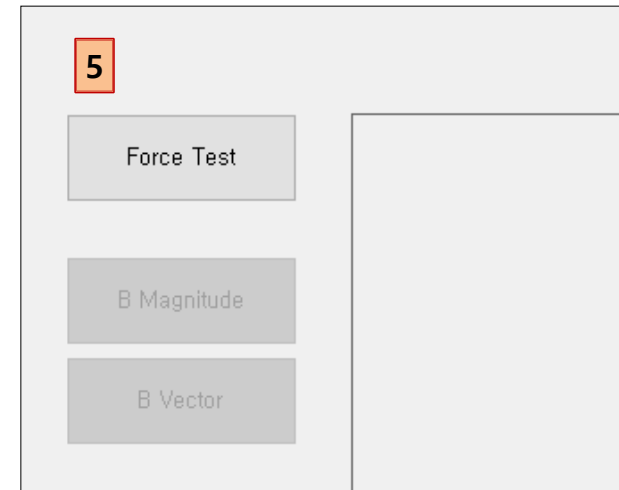
Virtual Test

자기력 가상실험

1. Toolbar > Force 버튼 클릭
2. Test Name : "force"
3. OK 버튼 클릭
4. 자기력 가상실험 설정
 - ✓ Voltage : 14.5 V
5. Force Test 버튼 클릭



✓ Common Fields	
Node Name	force 4
✓ Current Fields	
Voltage [V]	14.5
Max. Current [A]	0.95335
✓ Stroke Fields	
Moving Stroke [mm]	0
✓ Condition Fields	
Mesh Size [%]	2



자기력 가상실험 결과

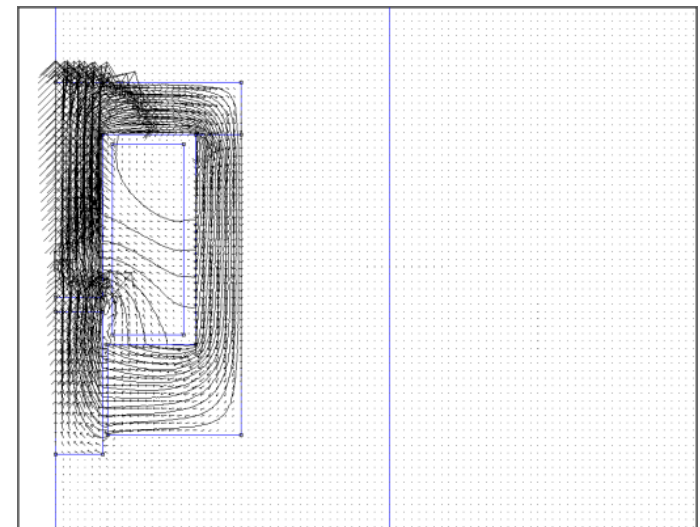
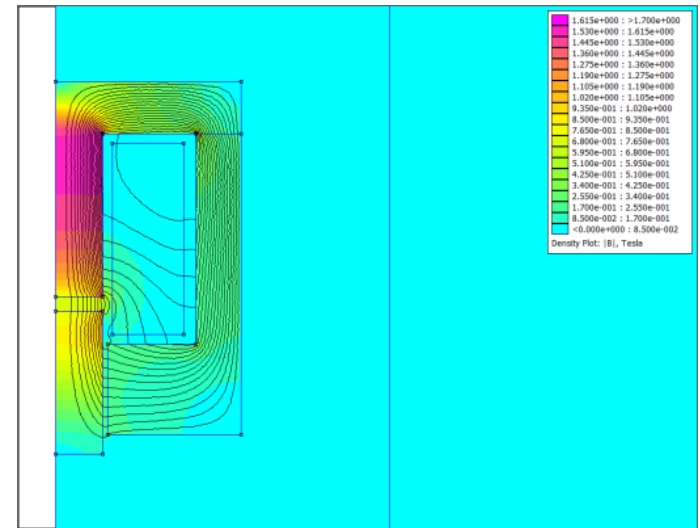
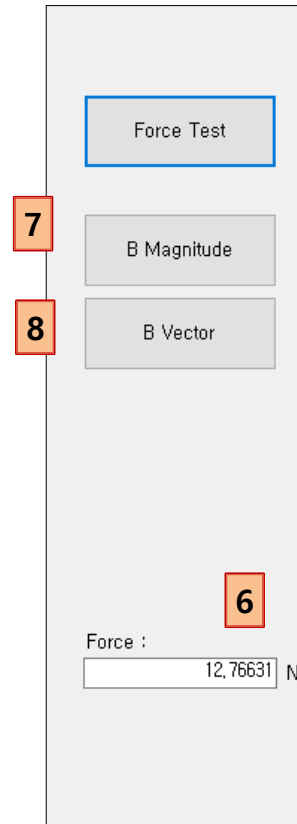
6. 자기력 확인 : 12.766 N

7. 자속밀도 확인

✓ B Magnitude 버튼 클릭

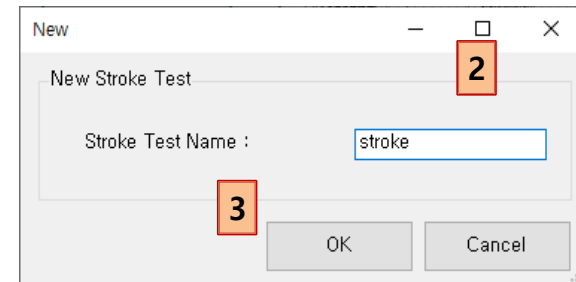
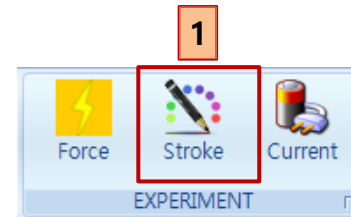
8. 자속밀도 벡터 확인

✓ B Vector 버튼 클릭



변위-자기력 가상실험

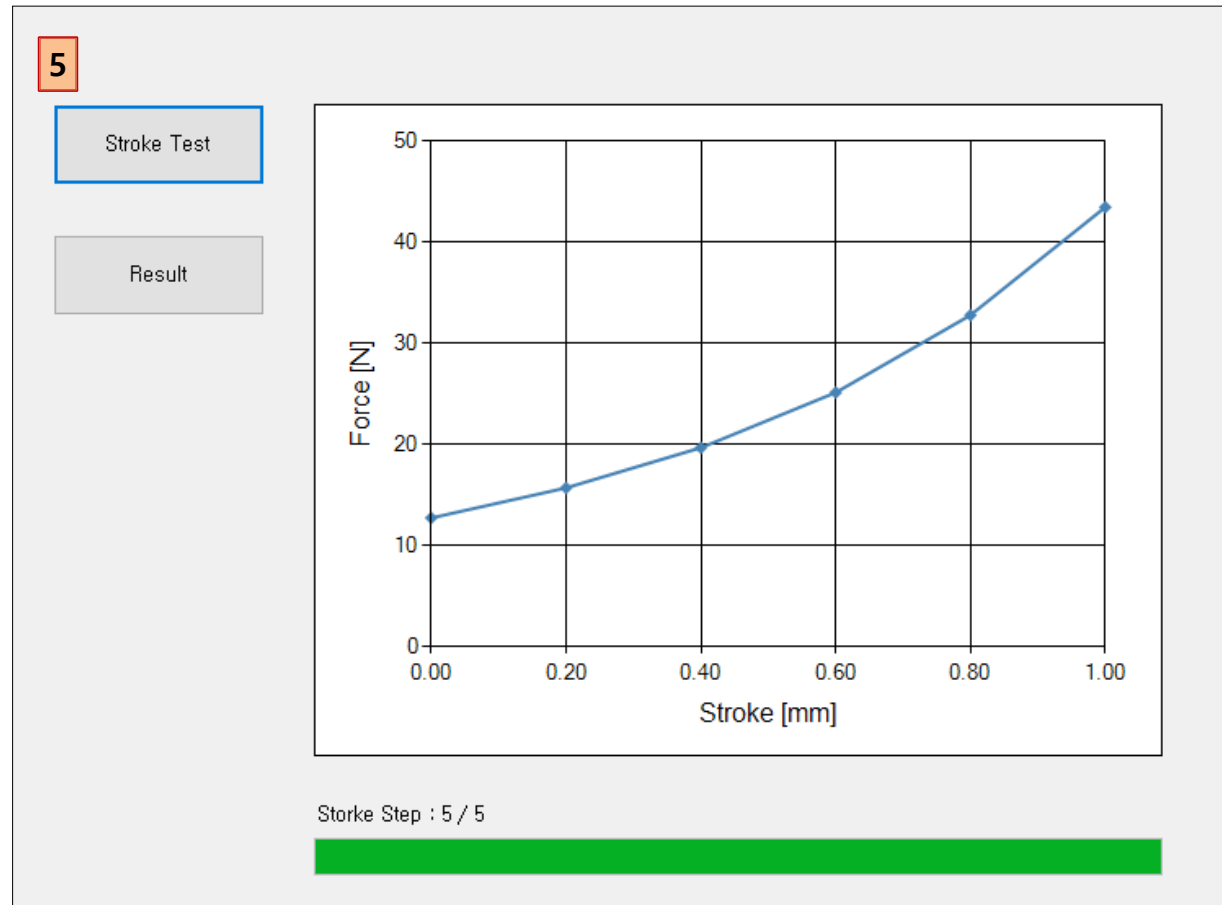
1. Toolbar > Stroke 버튼 클릭
2. Test Name 입력 : "stroke"
3. OK 버튼 클릭
4. 자기력-전류 가상실험 설정
 - ✓ Voltage : 14.5
 - ✓ Initial Stroke : 0.0
 - ✓ Final Stroke : 1.0
 - ✓ Step Count : 5



▼ Common Fields	
Node Name	stroke
▼ Current Fields	
Voltage [V]	14.5
Max. Current [A]	0.95335
▼ Stroke Fields	
Initial Stroke [mm]	0
Final Stroke [mm]	1
Step Count	5
▼ Condition Fields	
Mesh Size [%]	2

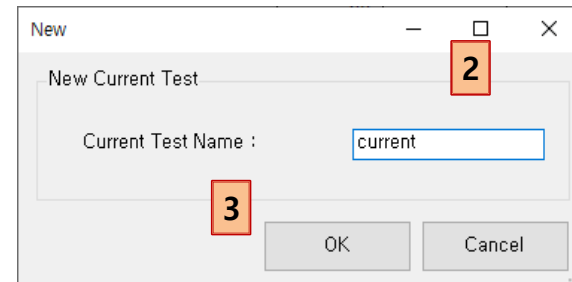
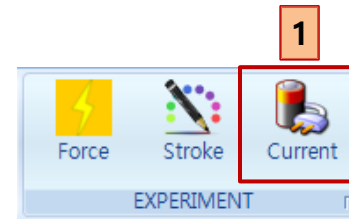
변위-자기력 가상실험 결과

5. Stroke Test 버튼 클릭



전류-자기력 가상실험

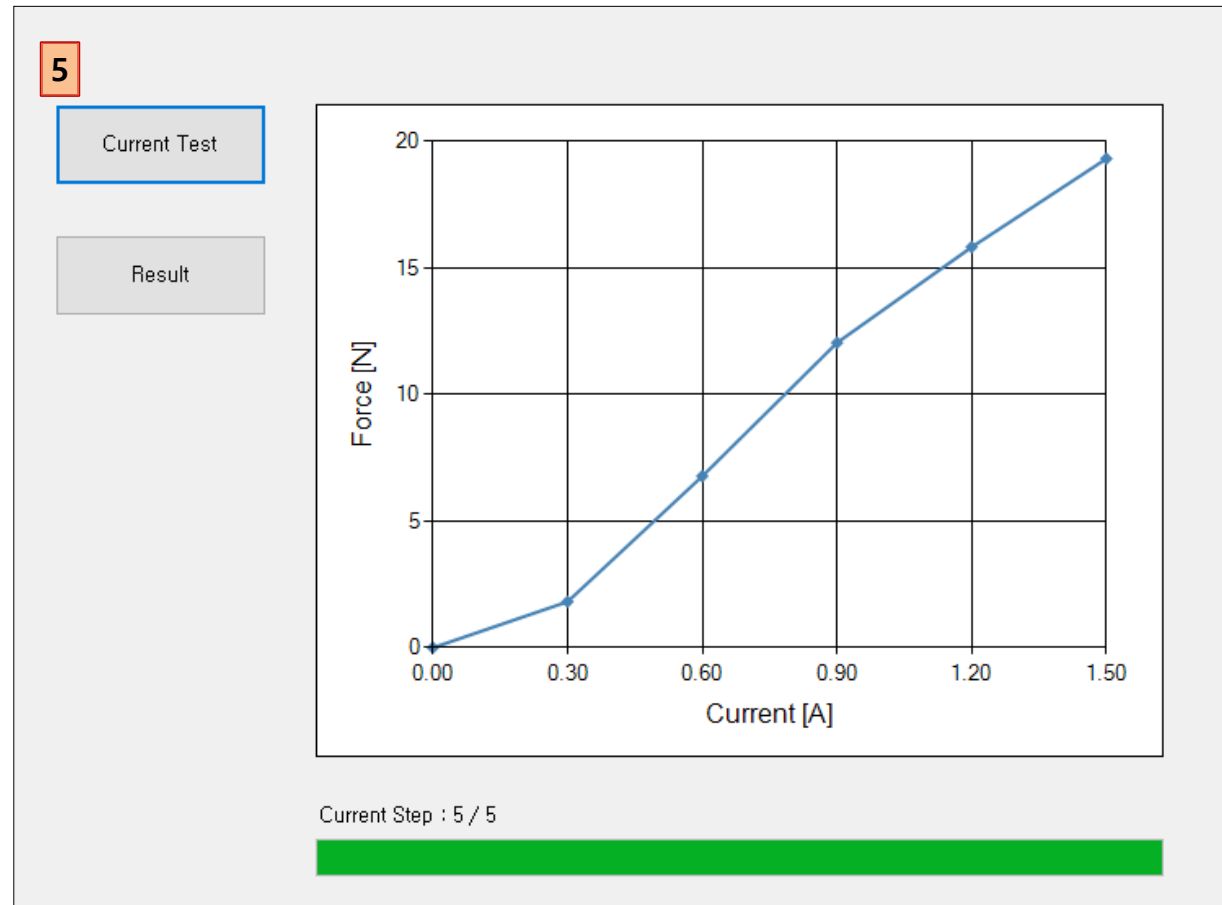
1. Toolbar > Current 버튼 클릭
2. Test Name 입력 : "current"
3. OK 버튼 클릭
4. 자기력-전류 가상실험 설정
 - ✓ Initial Current : 0.0
 - ✓ Final Current : 1.5
 - ✓ Step Count : 5



▼ Common Fields	
Node Name	current
▼ Current Fields	
Initial Current [A]	0
Final Current [A]	1.5
Step Count	5
▼ Stroke Fields	
Moving Stroke [mm]	0
▼ Condition Fields	
Mesh Size [%]	2

전류-자기력 가상실험 결과

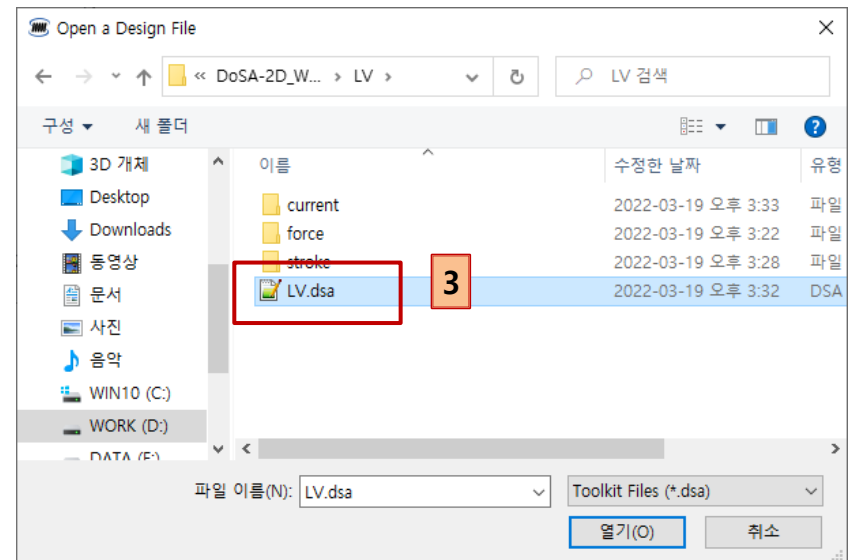
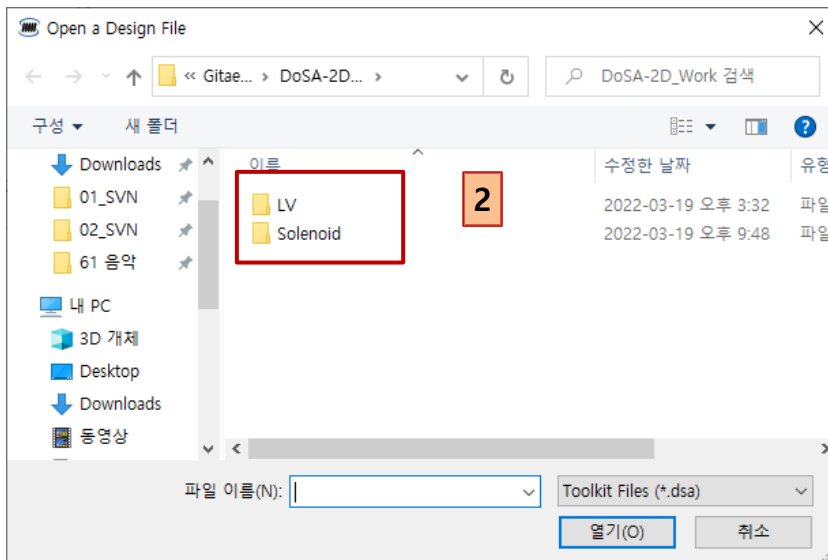
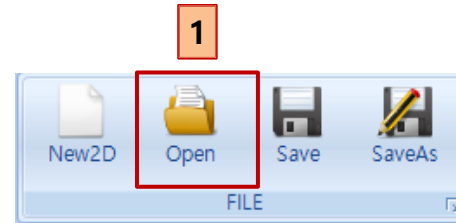
5. Current Test 버튼 클릭



Tips

Design 열기

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



Thank You

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Homepage : <http://openactuator.org>

