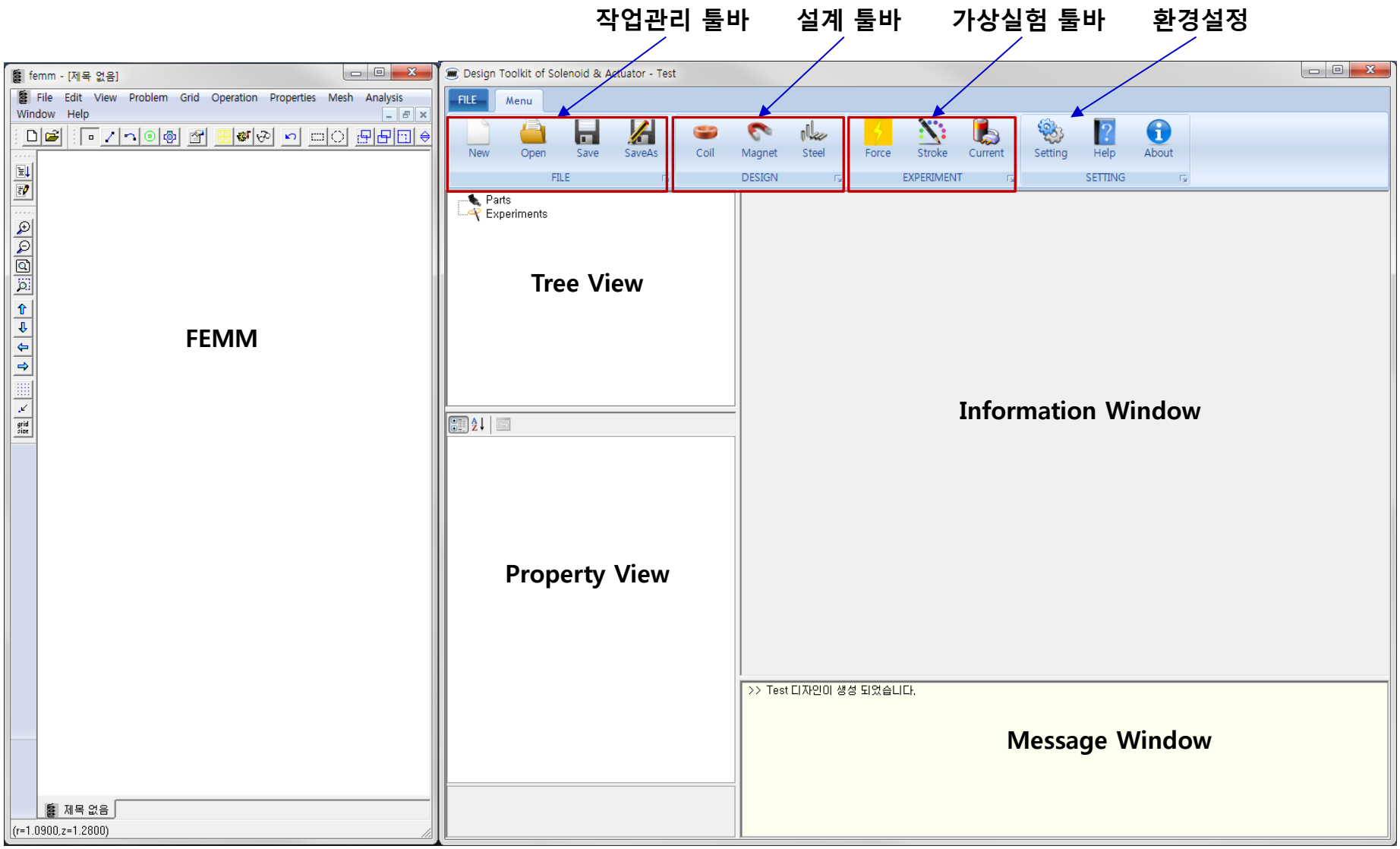
DoSA 사용 메뉴얼

Solenoid 예제

2017-11-18

http://OpenActuator.org (zgitae@gmail.com)

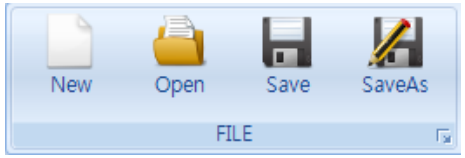
프로그램 구성


작업관리 툴바
설계 툴바
가상실험 툴바
환경설정
femm - [제목 없음]
File Edit View Problem Grid Operation Properties Mesh Analysis
Window Help
제목 없음
(r=1.0900,z=1.2800)
FEMM
Design Toolkit of Solenoid & Actuator - Test
FILE
Menu
New
Open
Save
SaveAs
Coil
Magnet
Steel
Force
Stroke
Current
Setting
Help
About
FILE
DESIGN
EXPERIMENT
SETTING
Parts
Experiments
Tree View
Property View
Information Window
>> Test 디자인이 생성 되었습니다.
Message Window

프로그램 Toolbar

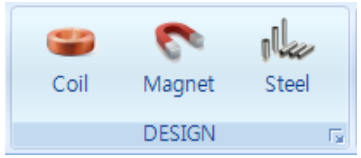
1. 작업관리

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



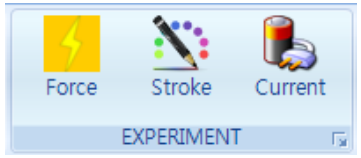
2. 설계

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



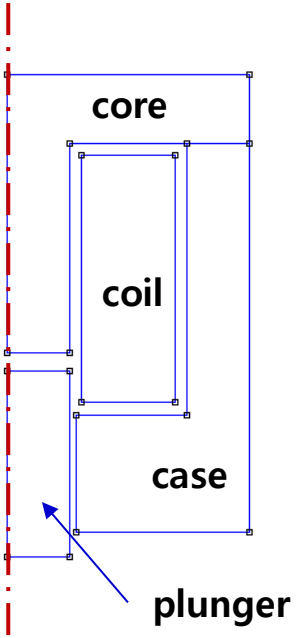
3. 가상실험

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



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 설치 디렉토리 > Samples > Solenoid)

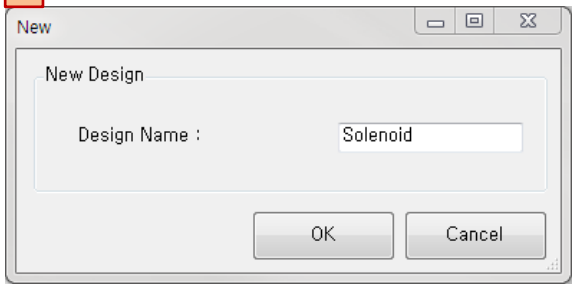
Design 생성

1. Toolbar > New 버튼 클릭 

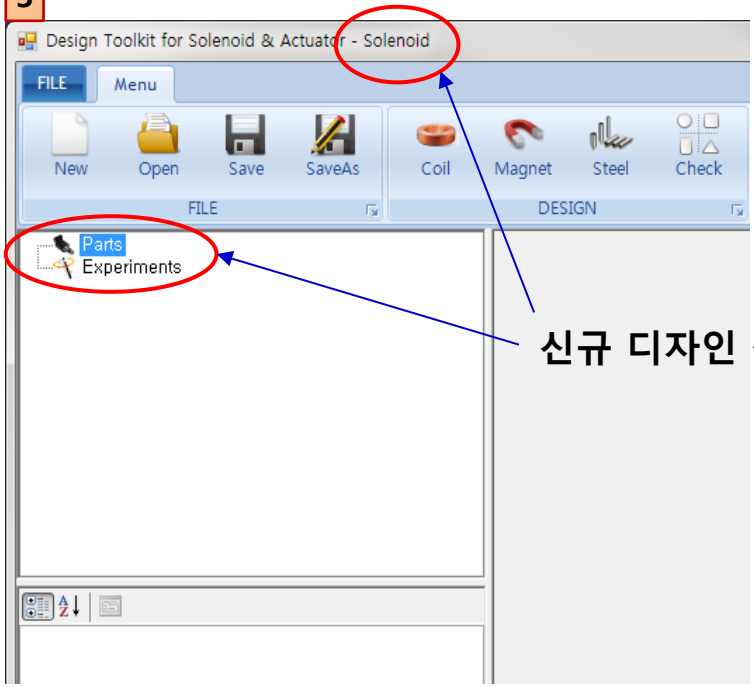
2. Design Name : 작업 명칭 입력 (Solenoid)

3. OK 클릭

2



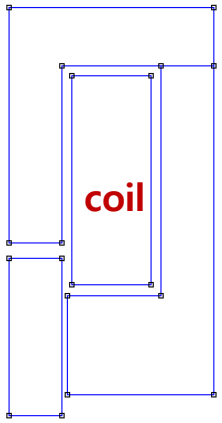
3



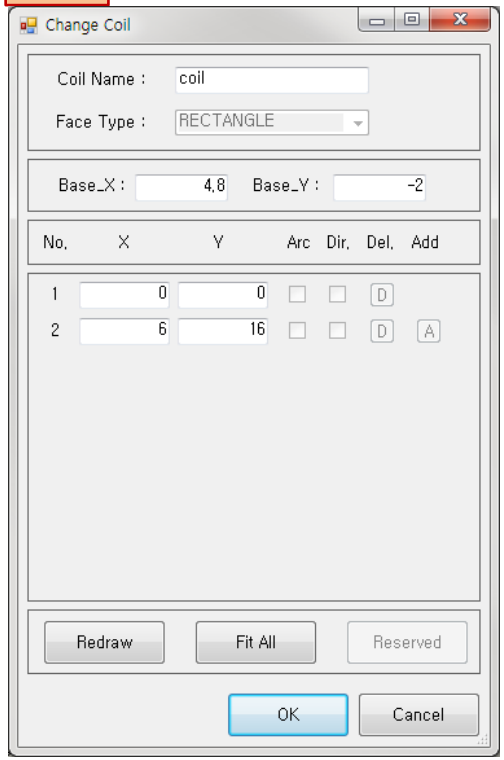
Coil 생성

1. Toolbar > Coil 버튼 클릭

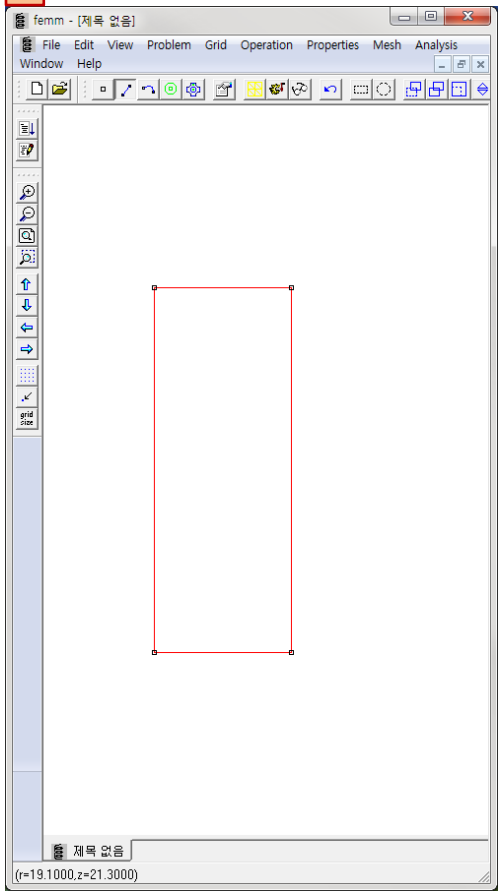
2. Coil Name 입력 : “coil”
3. Coil 형상 입력
   - ✓ 코일 위치 : Base_X 4.8, Base_Y -2
   - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
   - ✓ 우상 점 : X 6, Y 16 (상대 좌표)
4. 화면 조정 : Fit All 버튼 사용
5. OK 버튼 클릭
6. 형상 확인 (FEMM 창)



2~4



5



Coil 설계

1. Coil 기구사양 입력
   - ✓ Part Material : Copper 선택
   - ✓ Current Direction : IN 선택 (안쪽 방향)
   - ✓ Moving Parts : FIXED 선택 (고정 부품)
   - ✓ Coil Wire Grade : Enameled_IEC_Grade_2 선택
   - ✓ Copper Diameter : 0.27 mm 입력
   - ✓ Horizontal Coefficient : 기본값
   - ✓ Vertical Coefficient : 기본값
   - ✓ Resistance Coefficient : 기본값

2. Coil 사양 계산
   - ✓ Design Coil 버튼 클릭

2

Coil Design

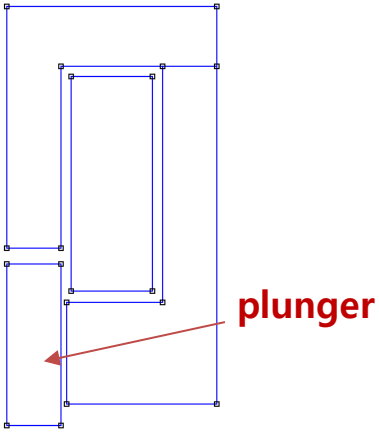
1

Common Fields	
Node Name	**coil**
Specification Fields	
Part Material	**Copper**
Curent 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 [℃]	**20**
Horizontal Coefficient	**0.9**
Vertical Coefficient	**0.98**
Resistance Coefficient	**1**

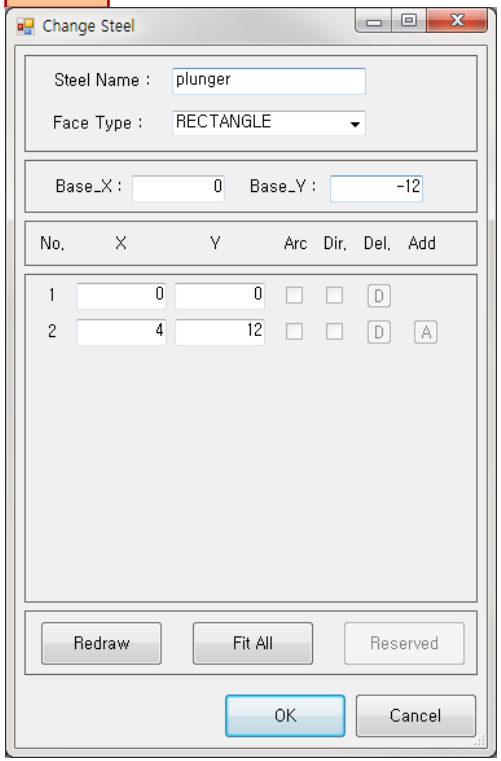
Plunger 생성

1. Toolbar > Steel 버튼 클릭

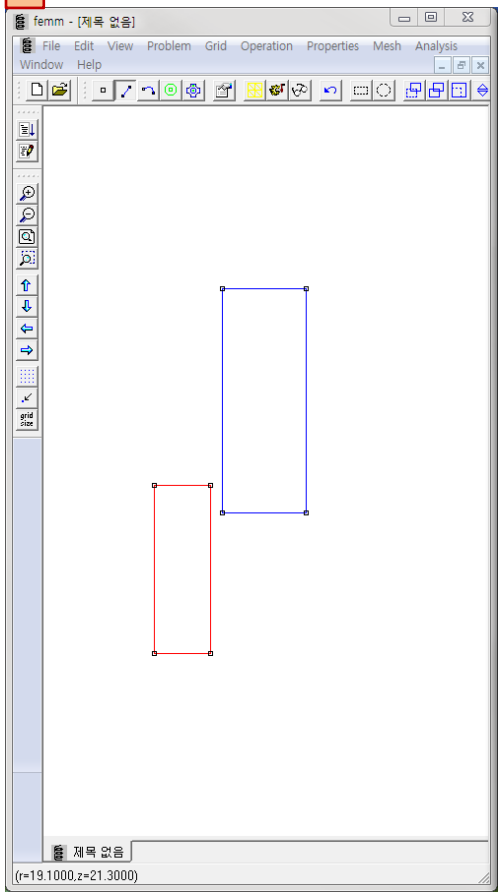
2. Steel Name 입력 : “plunger”
3. Face Type : RECTANGLE
4. Plunger 형상 입력
   - ✓ Plunger 위치 : Base_X 0, Base_Y -12
   - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
   - ✓ 우상 점 : X 4, Y 12 (상대 좌표)
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭
7. 형상 확인 (FEMM 창)



2~5



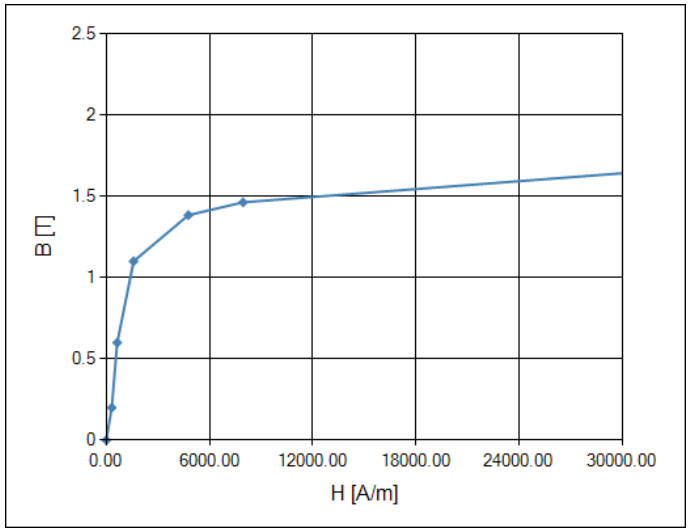
6



Plunger 설정

1. Plunger 속성 설정
   - ✓ Part Material : 430 Stainless Steel 선택
   - ✓ Moving Parts : Moving 선택 (동작 부품)

[BH 곡선]



1

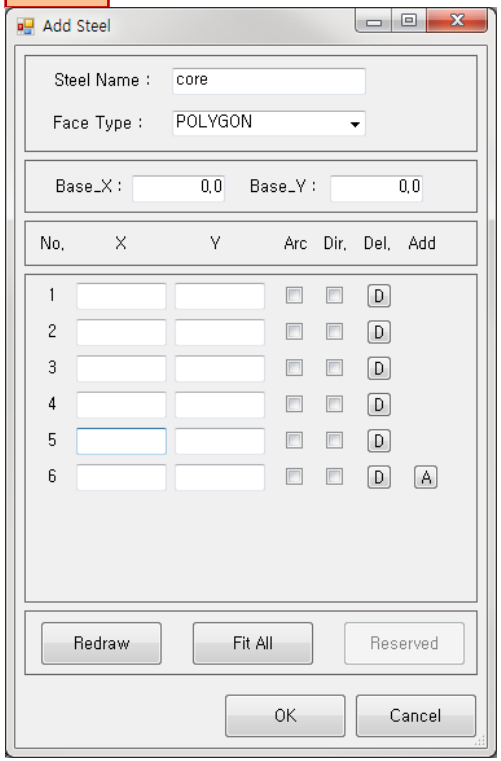
Common Fields	
Node Name	plunger
Specification Fields	
Part Material	430 Stainless Steel
Moving Parts	MOVING

Core 생성

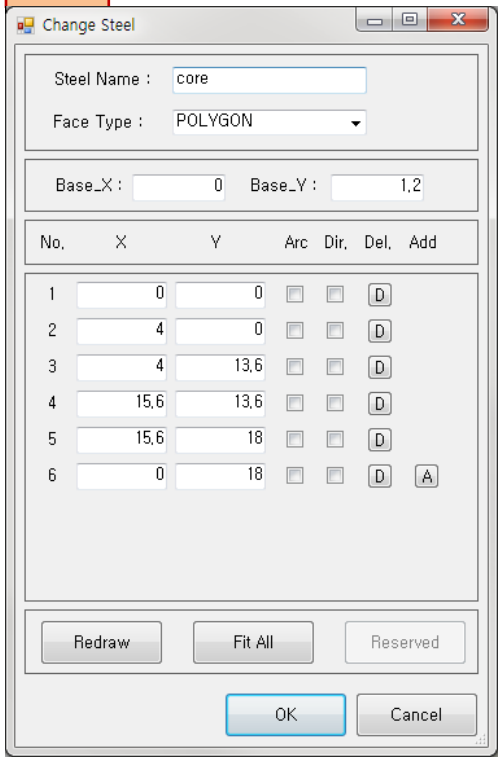
1. Toolbar > Steel 버튼 클릭 

2. Steel Name 입력 : "core"
3. 좌표점 추가 (총6개) : 'A' 버튼 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

2~3



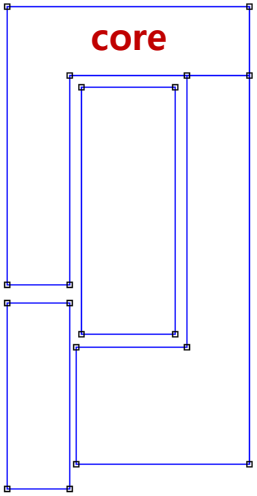
4~5



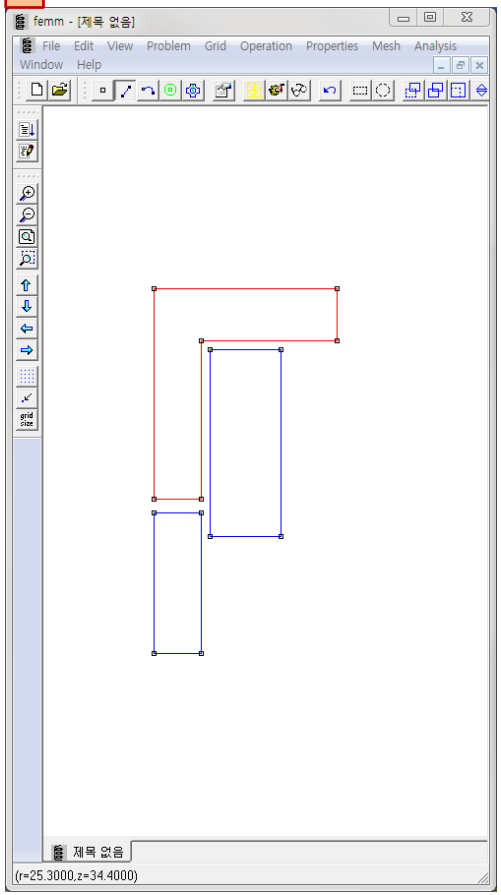
Core 설정

7. 형상 확인 (FEMM 창)

8. Core 속성 설정
   - ✓ Part Material : 430 Stainless Steel
   - ✓ Moving Parts : FIXED



6



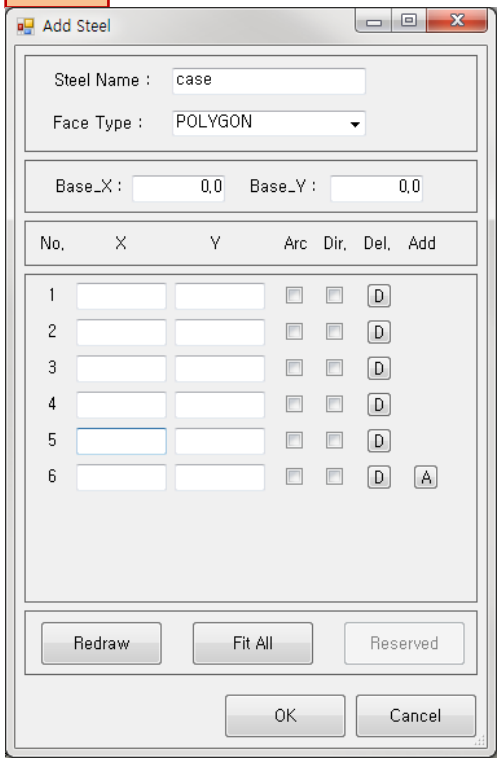
7

Case 생성

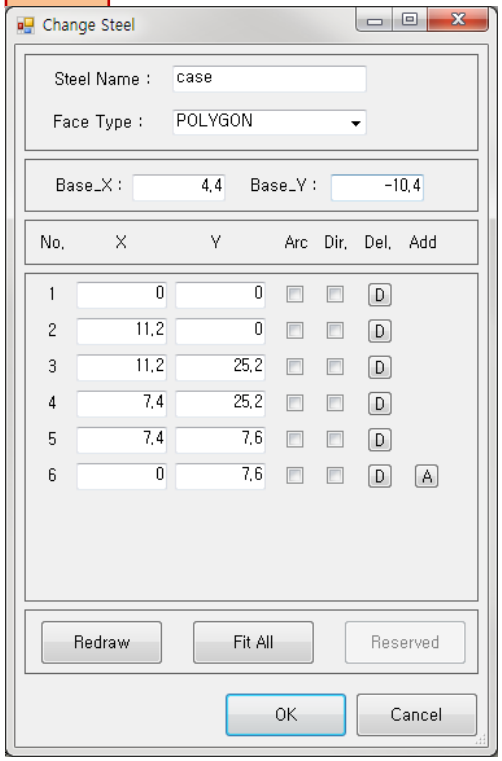
1. Toolbar > Steel 버튼 클릭 

2. Steel Name 입력 : "case"
3. 좌표점 추가 (총6개) : 'A' 버튼 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

2~3



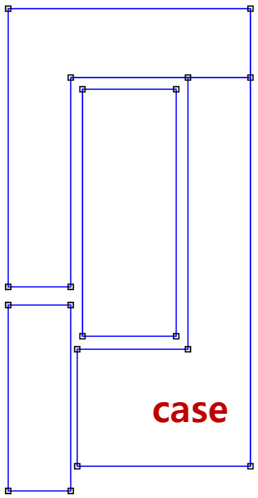
4~5



Case 설정

7. 형상 확인 (FEMM 창)

8. Case 속성 설정
   - ✓ Part Material : 1010 Steel
   - ✓ Moving Parts : FIXED



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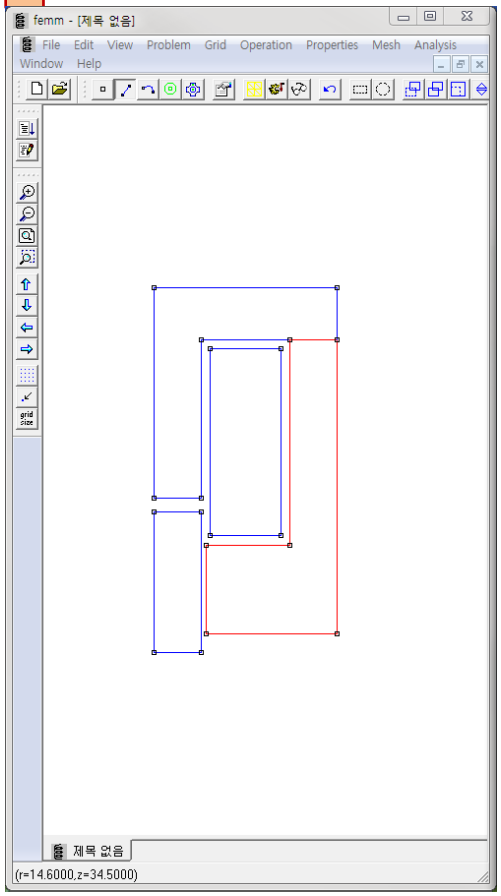


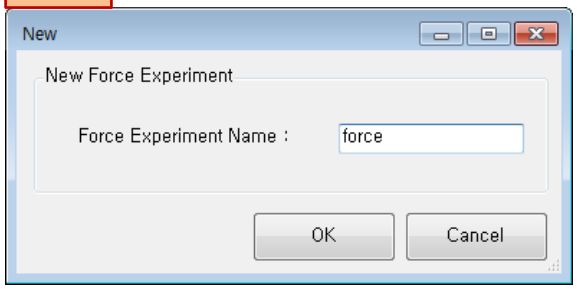
7

자기력 가상실험

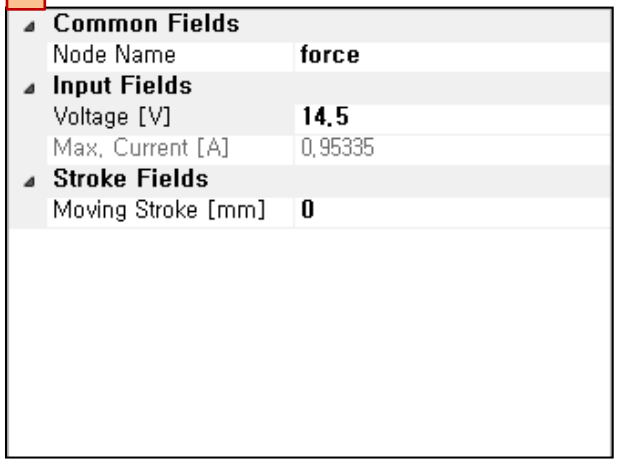
1. Toolbar > Force 버튼 클릭 

2. Experiment Name 입력 : “force”
3. OK 버튼 클릭
4. 자기력 가상실험 설정
   ✓ Voltage : 14.5 V
5. 자기력 가상실험 실행

2~3



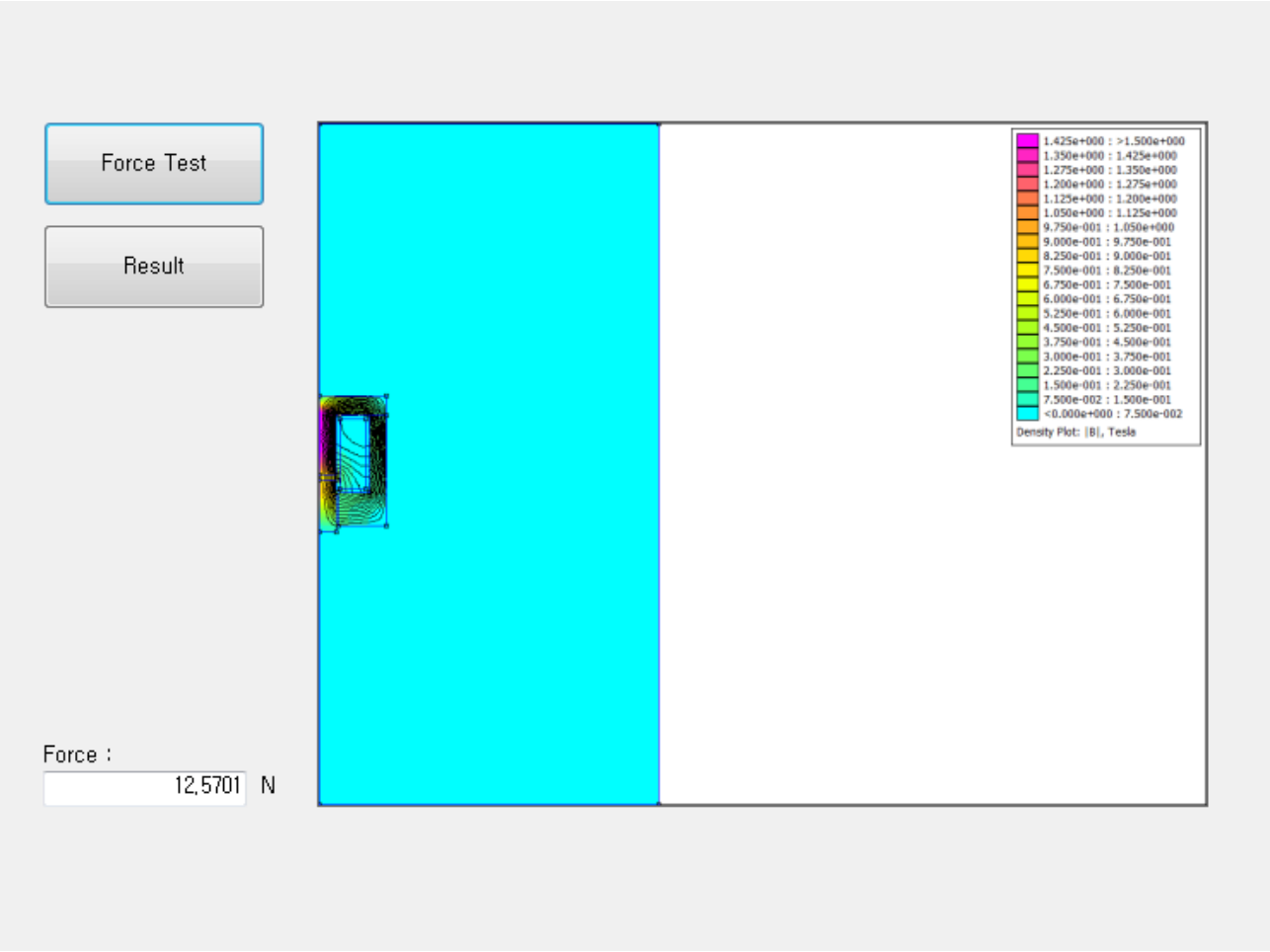
4



5

자기력 가상실험 결과

1. Force : 12.57 N

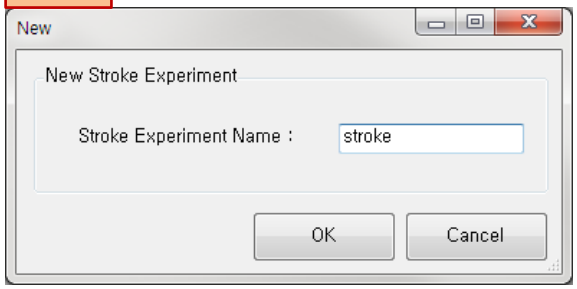


변위-자기력 가상실험

1. Toolbar > Stroke 버튼 클릭

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

2~3

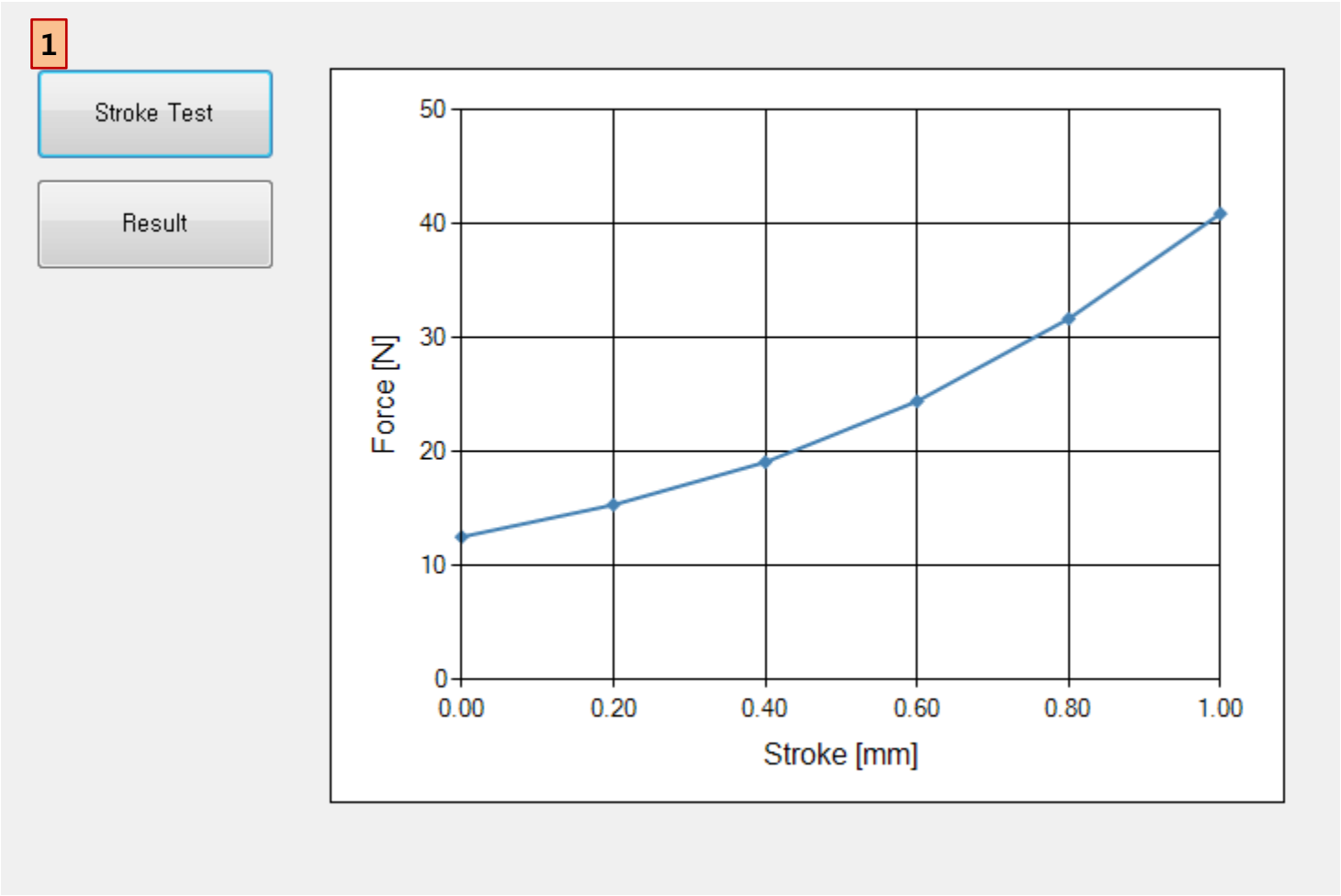


4

Common Fields	
Node Name	**stroke**
Input Fields	
Voltage [V]	**14.5**
Max. Current [A]	0.95335
Stroke Fields	
Initial Stroke [mm]	**0**
Final Stroke [mm]	**1**
Step Count	**5**

변위-자기력 가상실험 결과

1. Information View / Stroke Test 버튼을 클릭

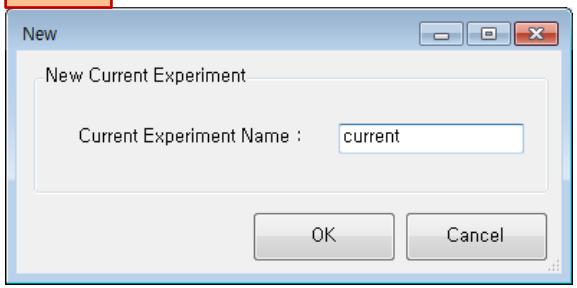


전류-자기력 가상실험

1. Toolbar > Current 버튼 클릭 

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

2~3

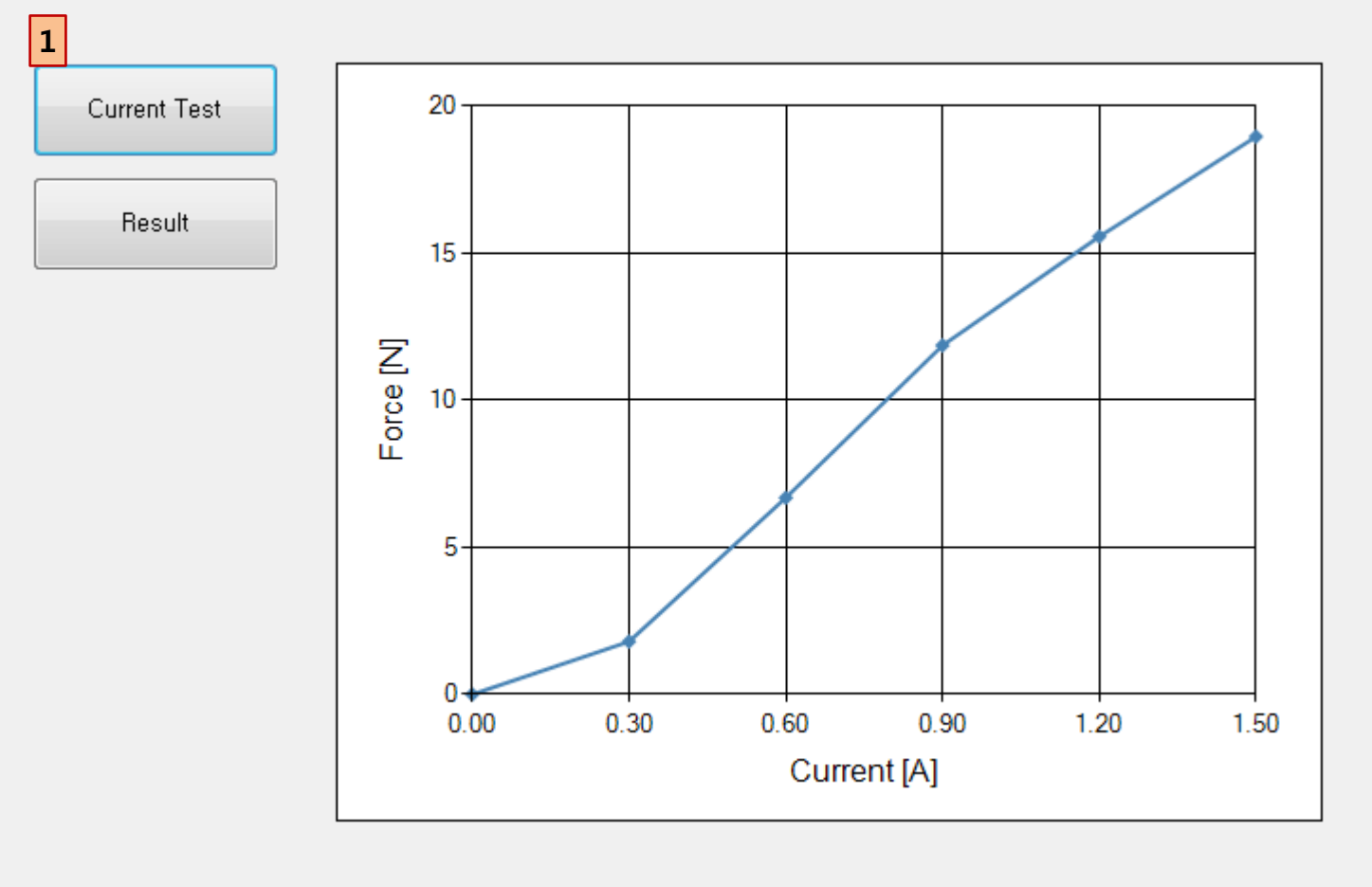


4

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**

전류-자기력 가상실험 결과

1. Information View / Current Test 버튼을 클릭



– Thank You –