

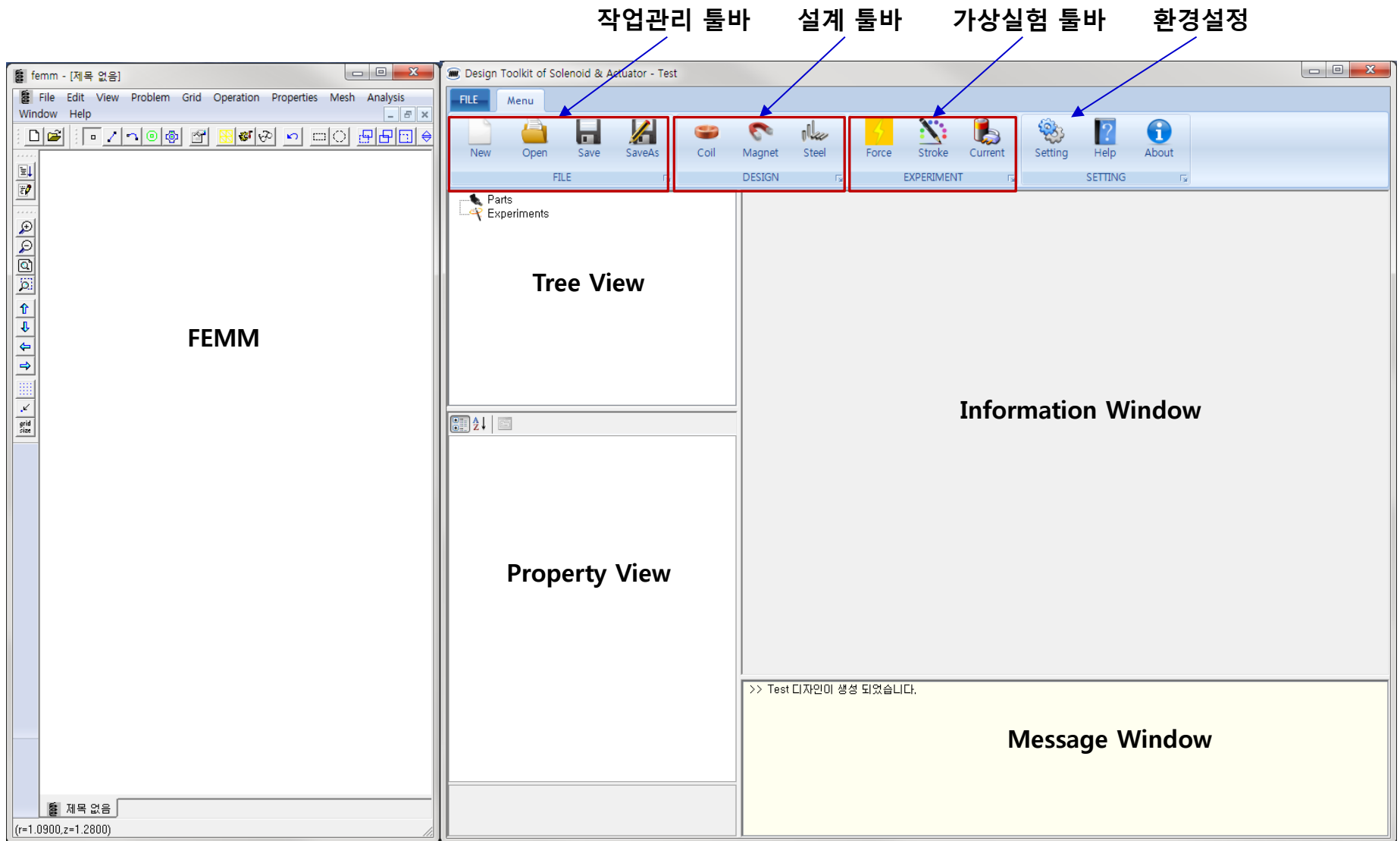
DoSA 사용 메뉴얼

Linear Vibrator (VCM 방식) 예제

2017-11-07

<http://OpenActuator.org>

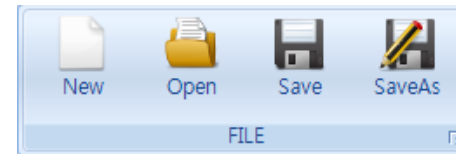
프로그램 구성



프로그램 Toolbar

1. 작업관리

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



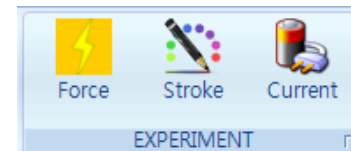
2. 설계

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



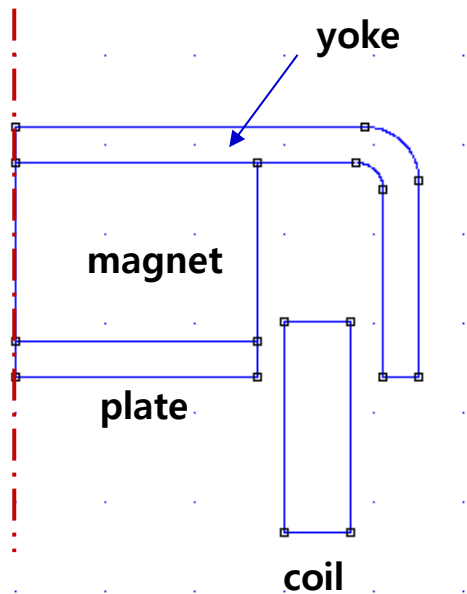
3. 가상실험

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



해석모델 설명

1. 형상 모델



2. 제품 사양

가. 코일권선

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

나. 영구자석

- Material : NdFeB 52
- 착자방향 : 90 (UP)

다. 전원

- Voltage : 2.5V

(작업 예제파일 : DoSA 설치 디렉토리 > Samples > LV)

Design 생성

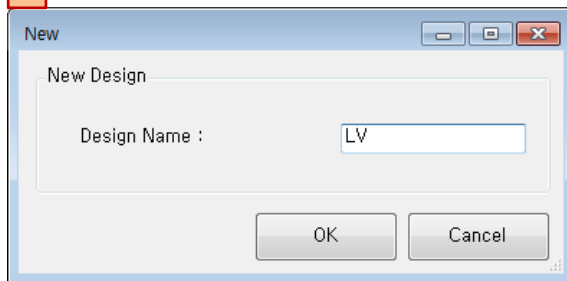
1. Toolbar > New 버튼 클릭



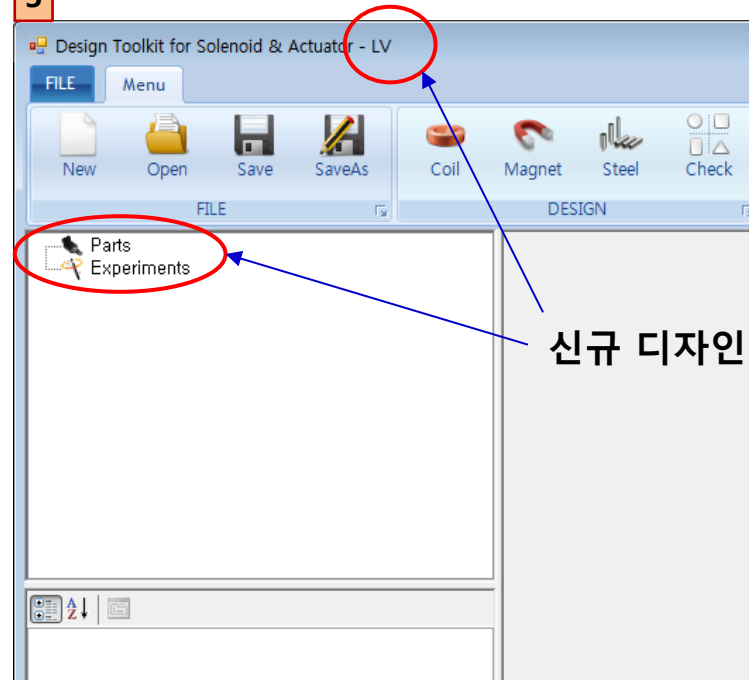
2. Design Name : 작업 명칭 입력 (LV)

3. OK 클릭

2



3



신규 디자인 생성

Coil 생성

1. Toolbar > Coil 버튼 클릭



2. Coil Name 입력 : "coil"

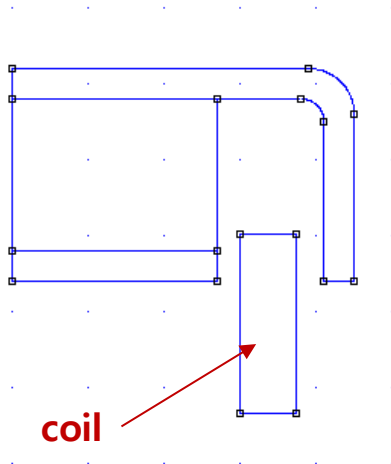
3. Coil 형상 입력

- ✓ 코일 위치 : Base_X 1.5, Base_Y -0.67
- ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
- ✓ 우상 점 : X 0.365, Y 1.18 (상대 좌표)

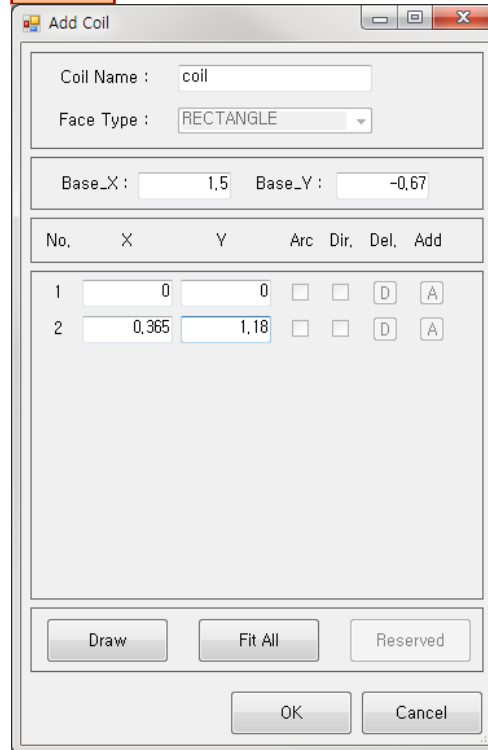
4. 화면 조정 : Fit All 버튼 사용

5. OK 버튼 클릭

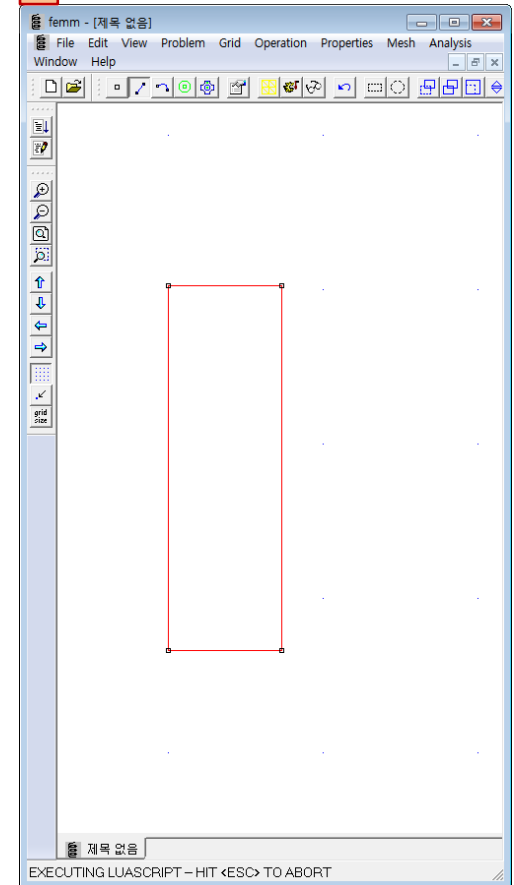
6. 형상 확인 (FEMM 창)



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 : Bonded_IEC_Grade_1B 선택
- ✓ Copper Diameter : 0.045 mm 입력
- ✓ Horizontal Coefficient : 0.95 입력
- ✓ Vertical Coefficient : 1.13 입력
- ✓ Resistance Coefficient : 1.1 입력

2. Coil 사양 계산

- ✓ Design Coil 버튼 클릭

2

Coil Design

1

| | |
|---|---------------------|
| Common Fields | |
| Node Name | coil |
| Specification Fields | |
| Part Material | Copper |
| Current Direction | IN |
| Moving Parts | FIXED |
| 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 |

Magnet 생성

1. Toolbar > Magnet 버튼 클릭



2. Magnet Name 입력 : "magnet"

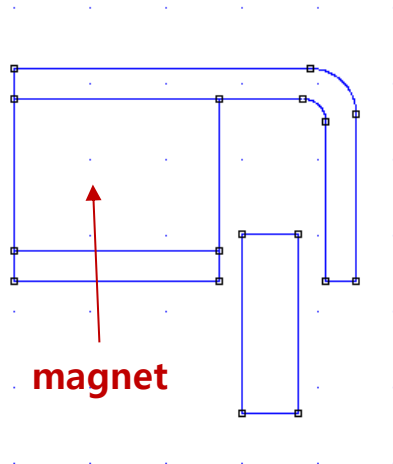
3. Magnet 형상 입력

- ✓ 자석 위치 : Base_X 0, Base_Y 0.4
- ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
- ✓ 우상 점 : X 1.35, Y 1 (상대 좌표)

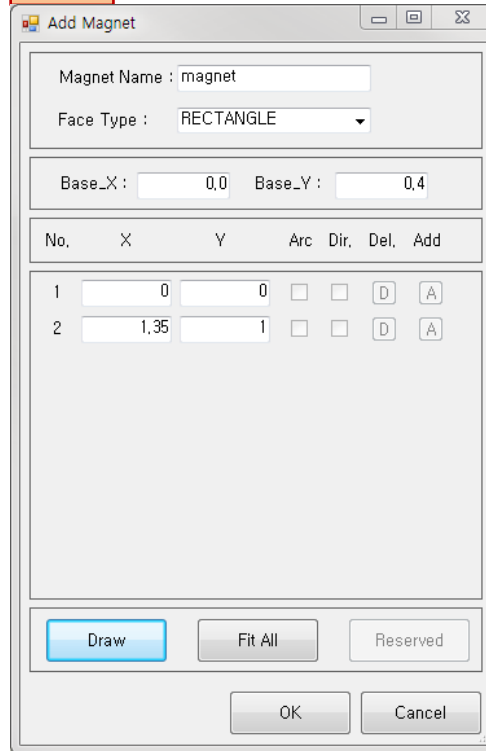
4. 화면 조정 : Fit All 버튼 사용

5. OK 버튼 클릭

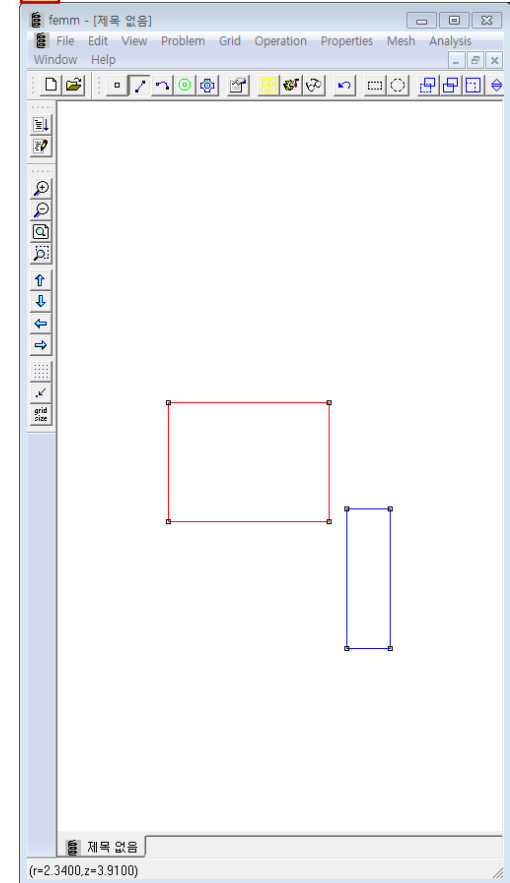
6. 형상 확인 (FEMM 창)



2~4



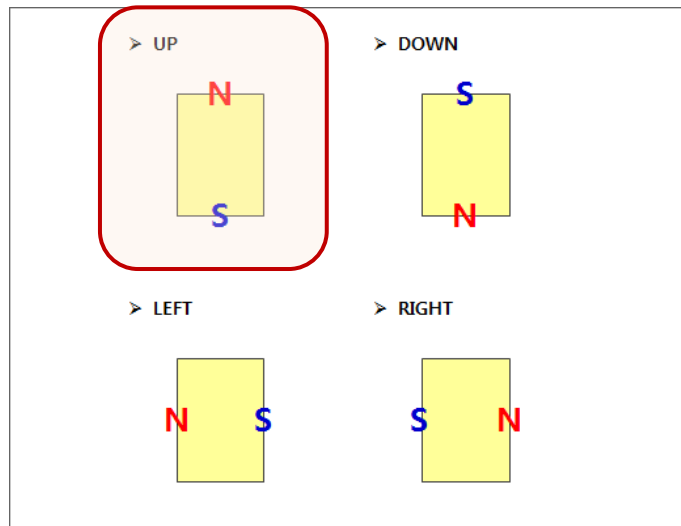
5



Magnet 설정

1. Magnet 속성 설정

- ✓ Part Material : NdFeB 52 MGOe 선택
- ✓ Direction : UP
- ✓ Moving Parts : Moving 선택 (동작 부품)



1

Common Fields

Node Name magnet

Specification Fields

Part Material NdFeB 52 MGOe

Direction UP

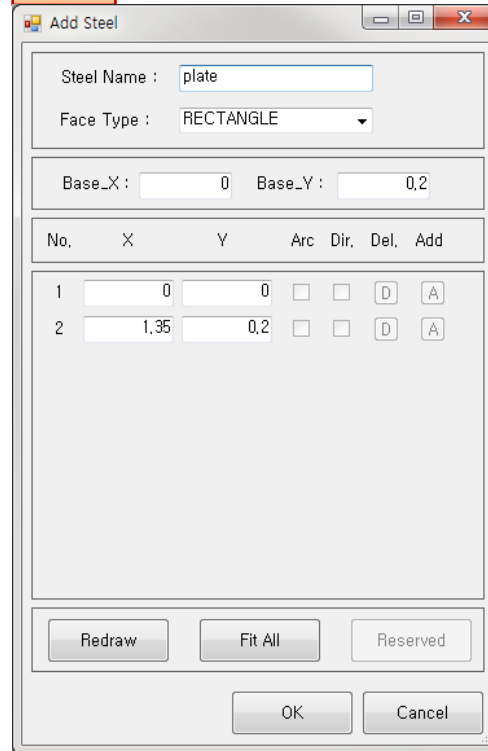
Moving Parts MOVING

Plate 생성

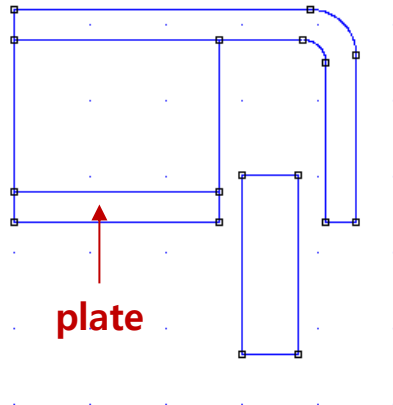
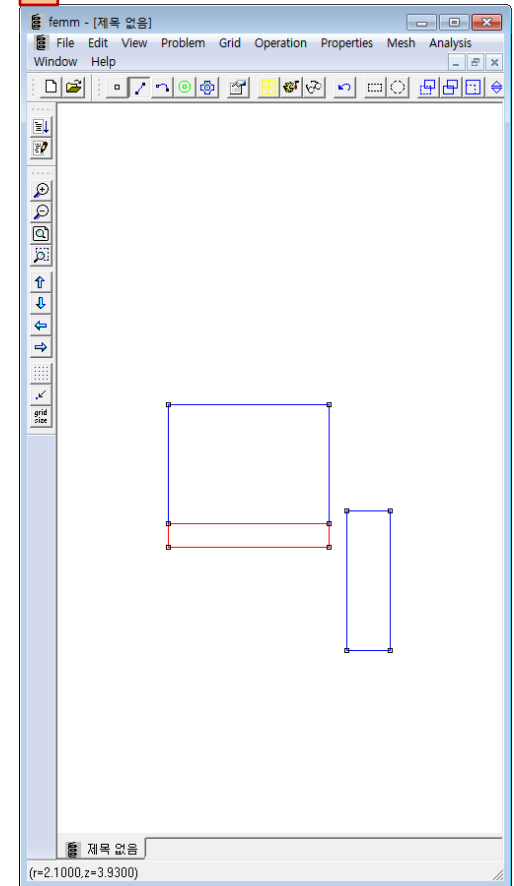
1. Toolbar > Steel 버튼 클릭
2. Steel Name 입력 : "plate"
3. Face Type : RECTANGLE 선택
4. Plate 형상 입력
 - ✓ 자석 위치 : Base_X 0, Base_Y 0.2
 - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
 - ✓ 우상 점 : X 1.35, Y 0.2 (상대 좌표)
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭
7. 형상 확인 (FEMM 창)



2~5



6



Yoke 생성

1. Toolbar > Steel 버튼 클릭



2. Steel Name 입력 : "plate"

3. 좌표점 추가 (총8개) : 'A' 버튼 클릭

4. Yoke 형상 입력

✓ Yoke 위치 : Base_X 0, Base_Y 0.2

✓ 1 점 : X 0, Y 1.4

✓ 2 점 : X 0, Y 1.2

✓ 3 점 : X 1.9, Y 1.2 (Arc, Dir 체크)

✓ 4 점 : X 2.05, Y 1.05

✓ 5 점 : X 2.05, Y 0

✓ 6 점 : X 2.25, Y 0

✓ 7 점 : X 2.25, Y 1.05 (Arc 체크)

✓ 8 점 : X 1.9, Y 1.4

5. 화면 조정 : Fit All 버튼 사용

6. OK 버튼 클릭

7. 형상 확인 (FEMM 창)

2~3

The 'Add Steel' dialog box is shown with the following settings:

- Steel Name : yoke
- Face Type : POLYGON
- Base_X : 0.0, Base_Y : 0.0

| No. | X | Y | Arc | Dir | Del | Add |
|-----|---|---|--------------------------|--------------------------|----------------------------------|----------------------------------|
| 1 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 2 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 3 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 4 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 5 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 6 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 7 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 8 | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | <input type="button" value="A"/> |

Buttons at the bottom: Redraw, Fit All, Reserved, OK, Cancel.

4~5

The 'Add Steel' dialog box is shown with the following settings:

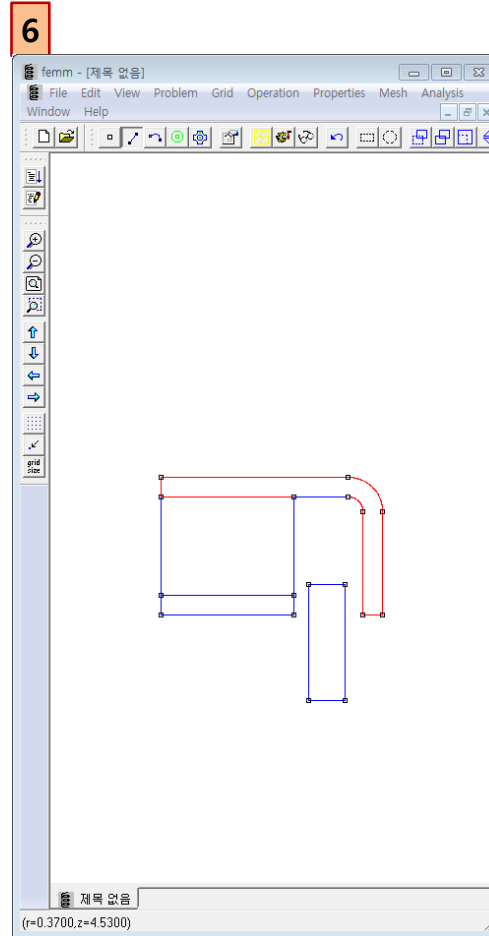
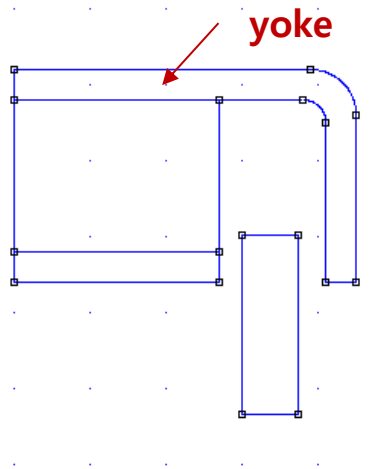
- Steel Name : yoke
- Face Type : POLYGON
- Base_X : 0.0, Base_Y : 0.2

| No. | X | Y | Arc | Dir | Del | Add |
|-----|------|------|-------------------------------------|-------------------------------------|----------------------------------|----------------------------------|
| 1 | 0 | 1.4 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 2 | 0 | 1.2 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 3 | 1.9 | 1.2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="button" value="D"/> | |
| 4 | 2.05 | 1.05 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 5 | 2.05 | 0 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 6 | 2.25 | 0 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 7 | 2.25 | 1.05 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | |
| 8 | 1.9 | 1.4 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="D"/> | <input type="button" value="A"/> |

Buttons at the bottom: Redraw, Fit All, Reserved, OK, Cancel.

Yoke 생성

6. 형상 확인 (FEMM 창)

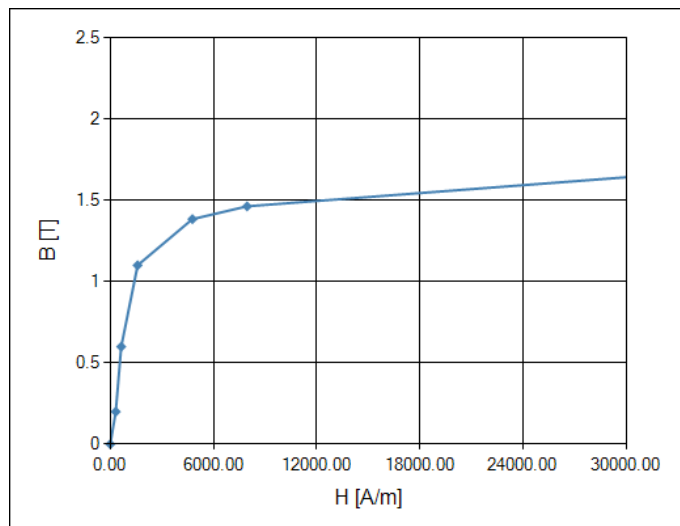


Plate, Yoke 설정

1. Plate, Yoke 속성 설정

- ✓ Part Material : 430 Stainless Steel 선택
- ✓ Moving Parts : Moving 선택 (동작 부품)

[BH 곡선]



1

Common Fields

Node Name plate

Specification Fields

Part Material 430 Stainless Steel

Moving Parts MOVING

자기력 가상실험

1. Toolbar > Force 버튼 클릭



2. Experiment Name 입력 : "force"

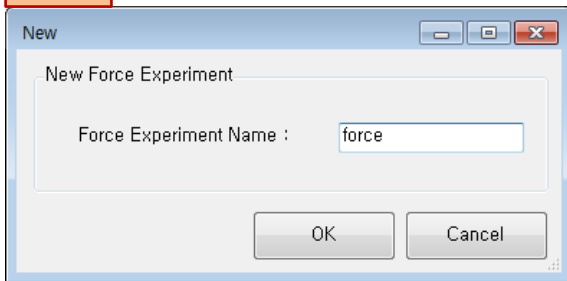
3. OK 버튼 클릭

4. 자기력 가상실험 설정

✓ Voltage : 2.5 V

5. 자기력 가상실험 실행

2~3



4

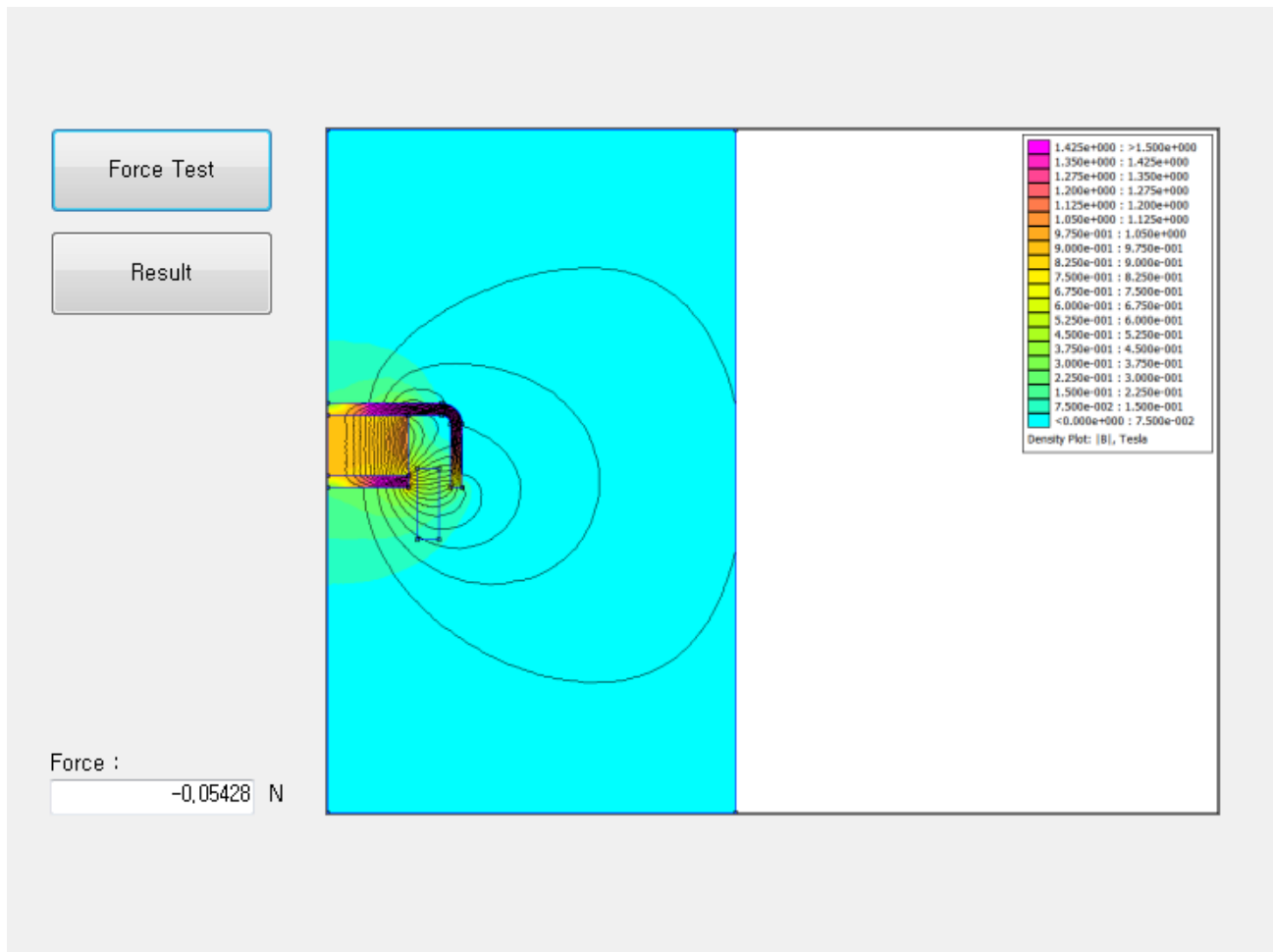
| | |
|--------------------|---------|
| Common Fields | |
| Node Name | force |
| Input Fields | |
| Voltage [V] | 2.5 |
| Max. Current [A] | 0.15875 |
| Stroke Fields | |
| Moving Stroke [mm] | 0 |

5



자기력 가상실험 결과

1. Force : -0.05428 N



변위-자기력 가상실험

1. Toolbar > Stroke 버튼 클릭



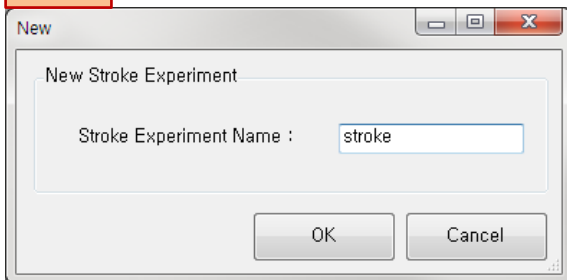
2. Experiment Name 입력 : "stroke"

3. OK 버튼 클릭

4. 자기력-전류 가상실험 설정

- ✓ Voltage : 2.5 V
- ✓ Initial Stroke : -0.5 mm
- ✓ Final Stroke : 0.5 mm
- ✓ Step Count : 5

2~3



4

| Common Fields | |
|---------------------|---------|
| Node Name | stroke |
| Input Fields | |
| Voltage [V] | 2.5 |
| Max. Current [A] | 0.15875 |
| Stroke Fields | |
| Initial Stroke [mm] | -0.5 |
| Final Stroke [mm] | 0.5 |
| Step Count | 5 |

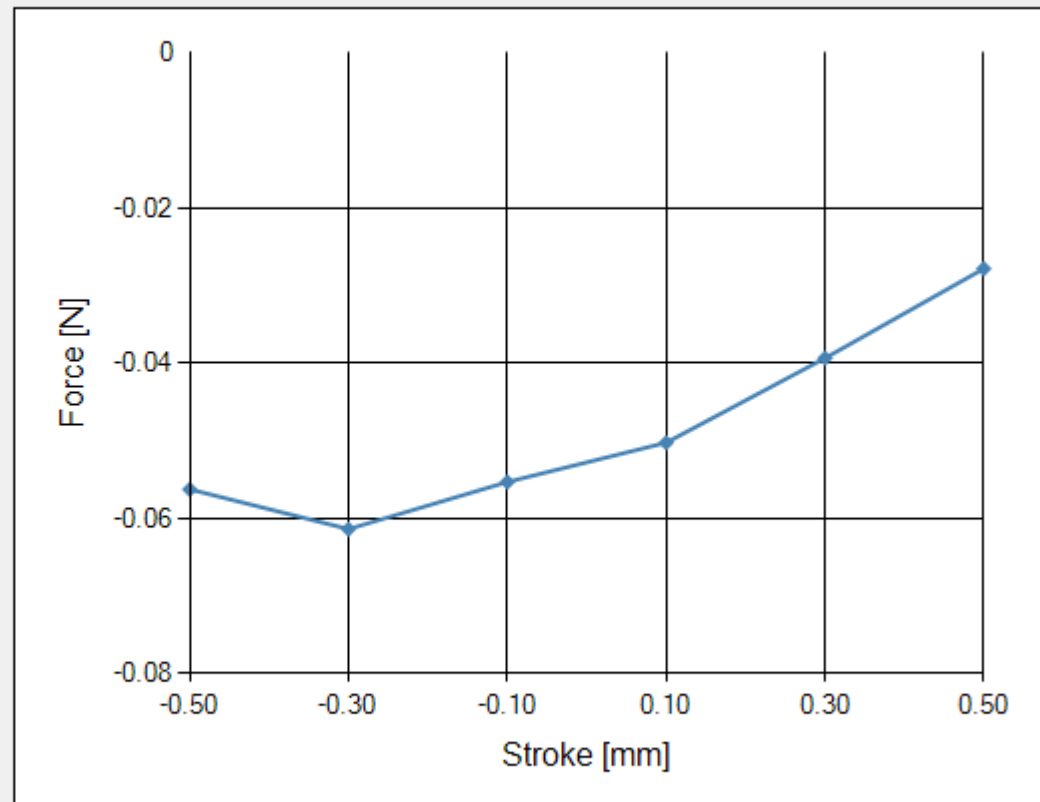
변위-자기력 가상실험 결과

1. Information View / Stroke Test 버튼을 클릭

1

Stroke Test

Result



전류-자기력 가상실험

1. Toolbar > Current 버튼 클릭



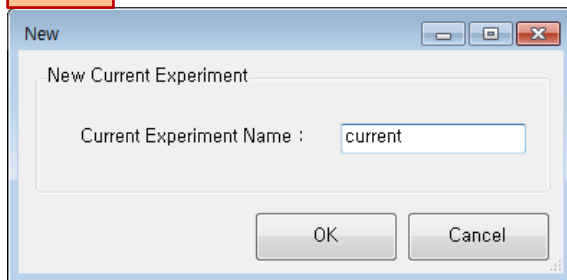
2. Experiment Name 입력 : "current"

3. OK 버튼 클릭

4. 자기력-전류 가상실험 설정

- ✓ Initial Current : 0.0 A
- ✓ Final Current : 0.1 A
- ✓ Step Count : 5

2~3



4

| Common Fields | |
|---------------------|---------|
| Node Name | current |
| Current Fields | |
| Initial Current [A] | 0 |
| Final Current [A] | 0.1 |
| Step Count | 5 |
| Stroke Fields | |
| Moving Stroke [mm] | 0 |

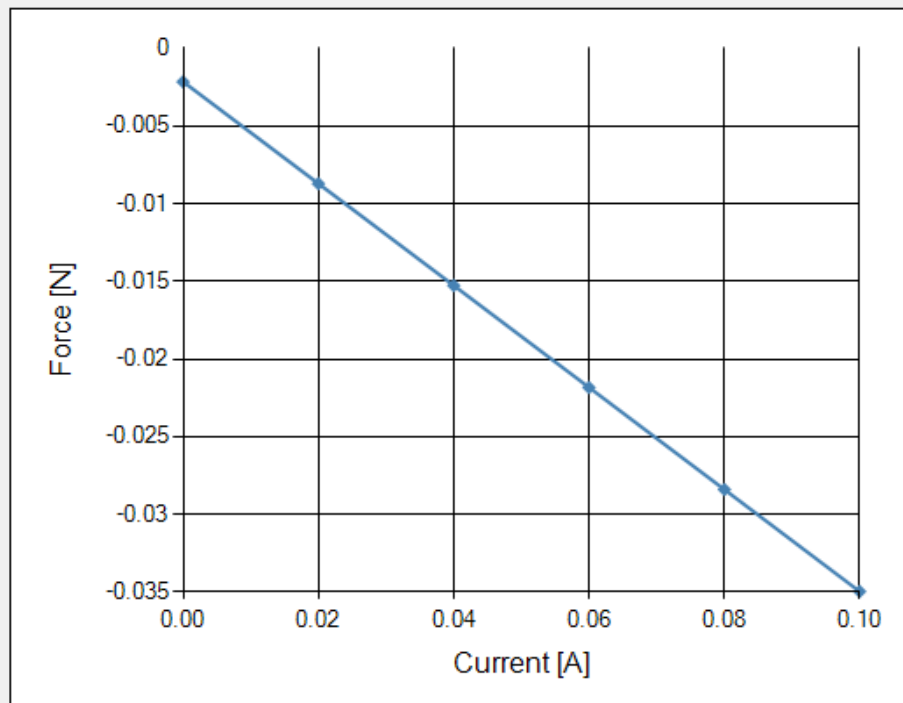
전류-자기력 가상실험 결과

1. Information View / Current Test 버튼을 클릭

1

Current Test

Result





– Thank You –
