

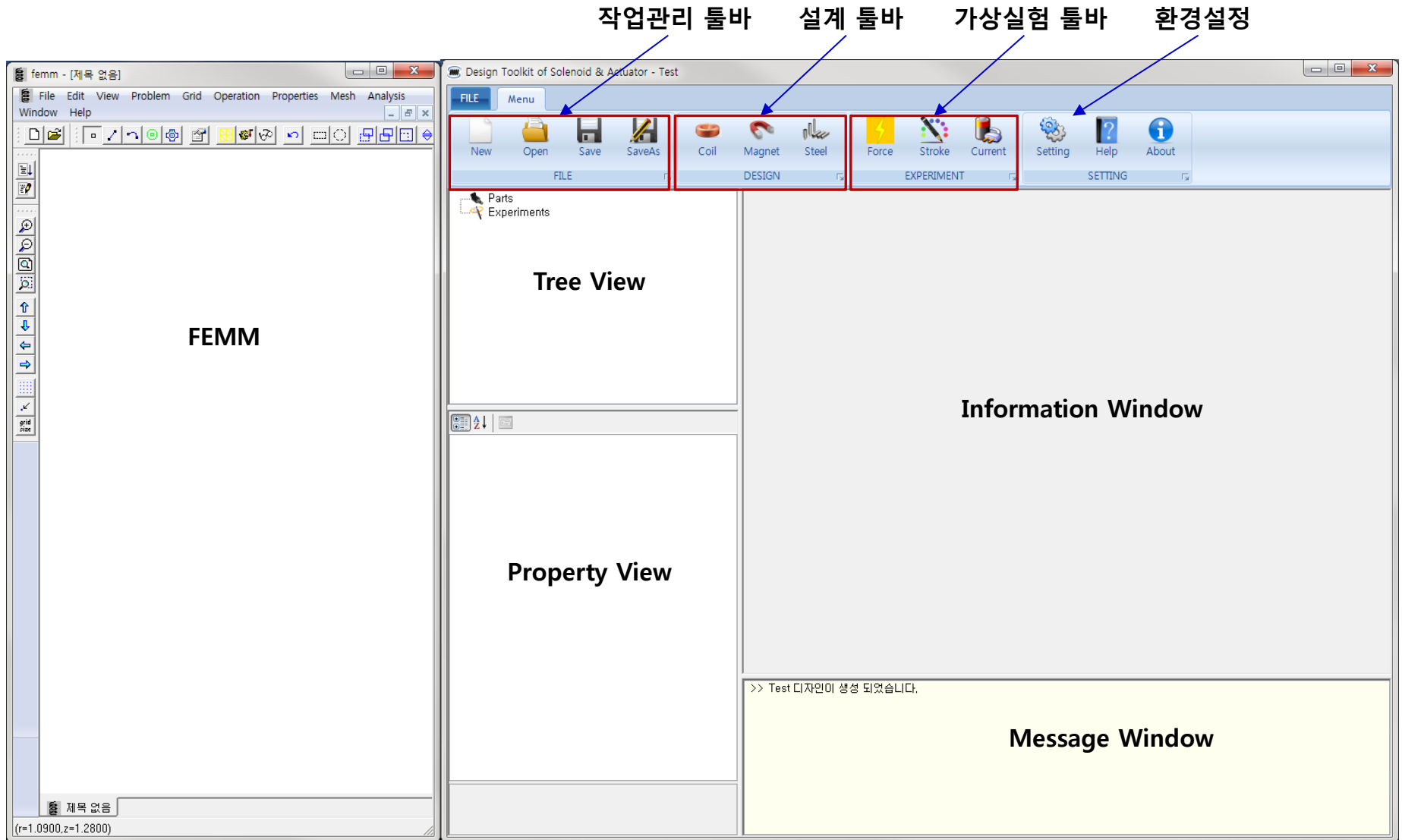
# DoSA 사용 메뉴얼

Linear Vibrator (VCM 방식) 예제

2017-11-18

<http://OpenActuator.org> (zgita@gmail.com)

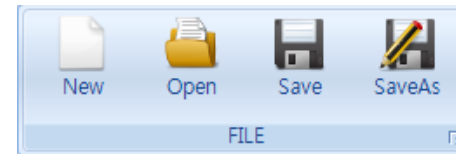
# 프로그램 구성



# 프로그램 Toolbar

## 1. 작업관리

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



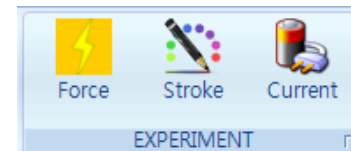
## 2. 설계

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



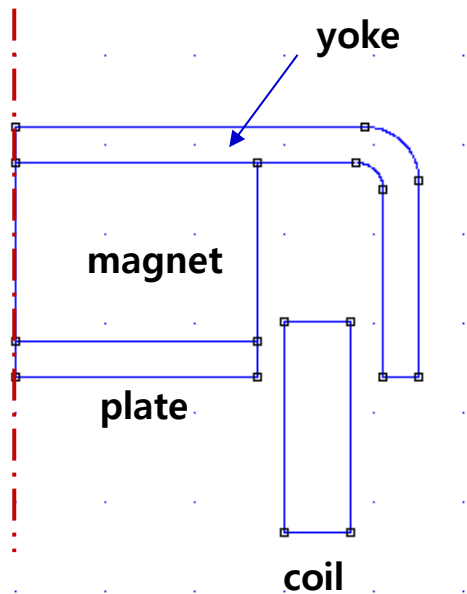
## 3. 가상실험

- ✓ 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

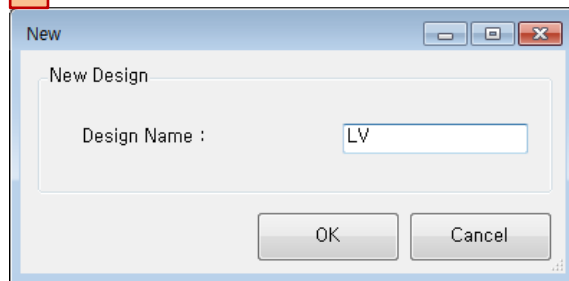
1. Toolbar > New 버튼 클릭



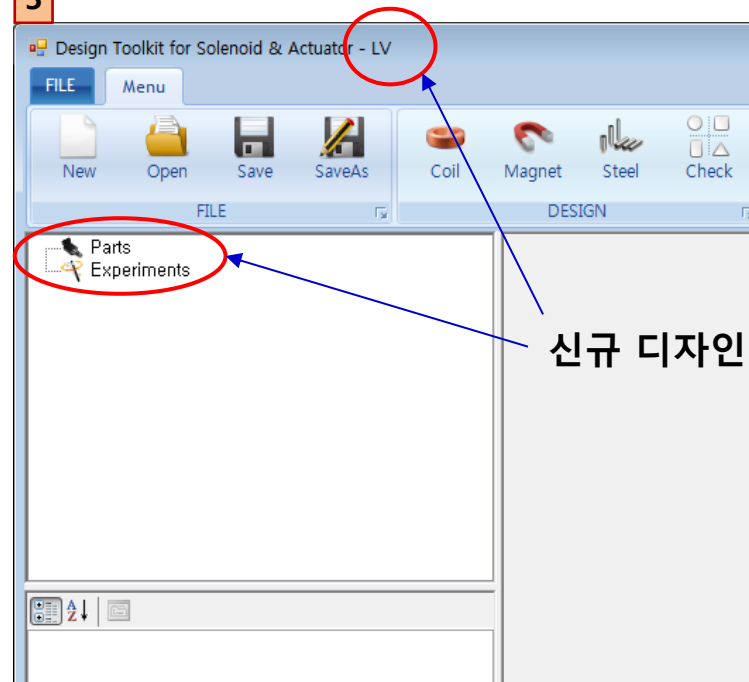
2. Design Name : 작업 명칭 입력 ( "LV" )

3. OK 클릭

2



3



신규 디자인 생성

# Coil 생성

1. Toolbar > Coil 버튼 클릭



2. Coil Name 입력 : "coil"

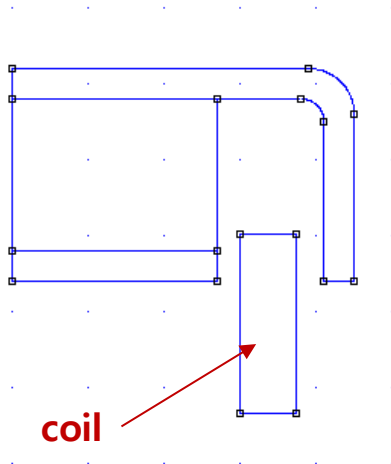
3. Coil 형상 입력

- ✓ 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)

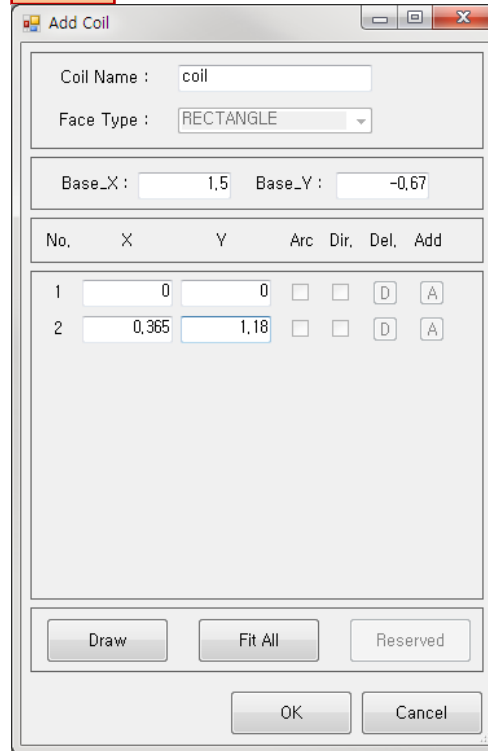
4. 화면 조정 : Fit All 버튼 사용

5. OK 버튼 클릭

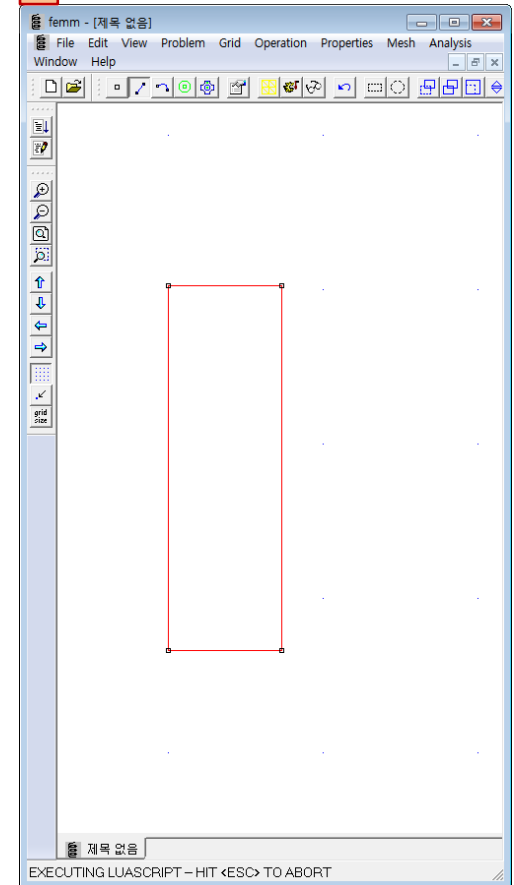
6. 형상 확인 (FEMM 창)



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

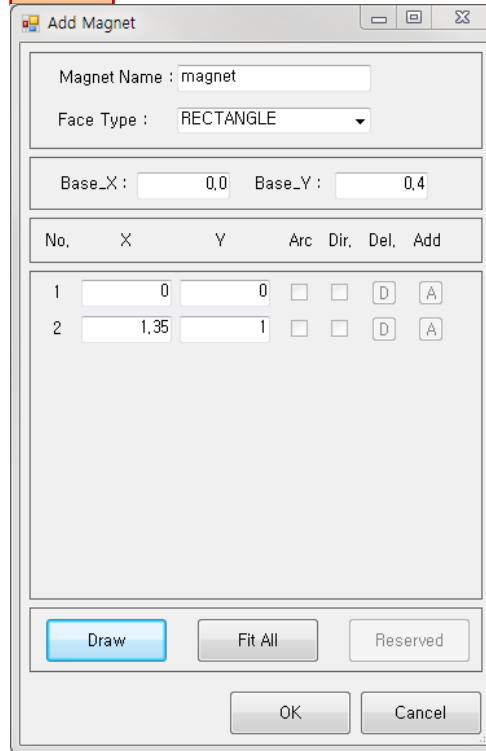
Common Fields	
Node Name	coil
Specification Fields	
Part Material	Copper
Current Direction	IN
Moving Parts	FIXED
Calculated Fields	
Coil Turns	126
Coil Resistance [ $\Omega$ ]	15,74769
Coil Layers	6
Turns of One Layer	21
Design Fields (optional)	
Coil Wire Grade	Bonded_IEC_Grade_1B
Inner Diameter [mm]	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 생성

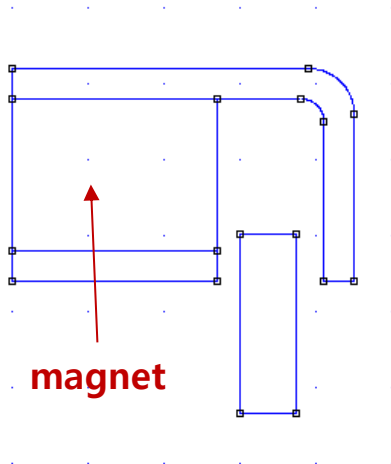
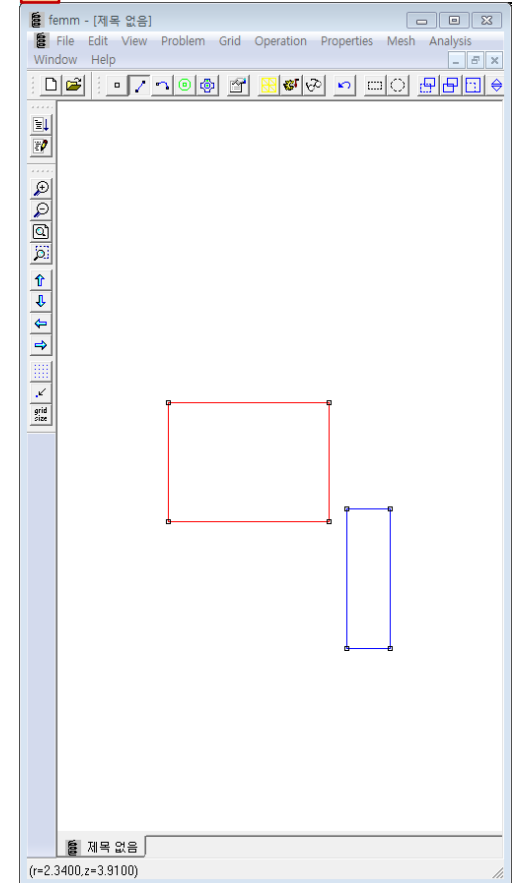
1. Toolbar > Magnet 버튼 클릭
2. Magnet Name 입력 : "magnet"
3. Magnet 형상 입력
  - ✓ 자석 위치 : Base\_X 0, Base\_Y 0.4
  - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
  - ✓ 우상 점 : X 1.35, Y 1 (상대 좌표)
4. 화면 조정 : Fit All 버튼 사용
5. OK 버튼 클릭
6. 형상 확인 (FEMM 창)



2~4



5

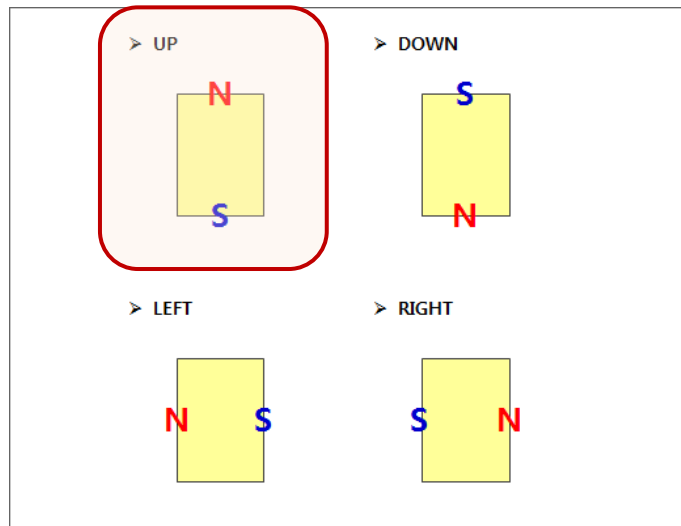




# Magnet 설정

## 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

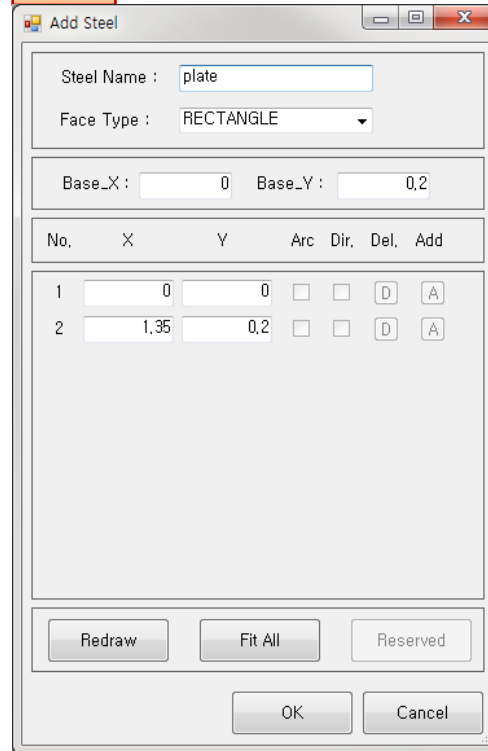
Moving Parts MOVING

# Plate 생성

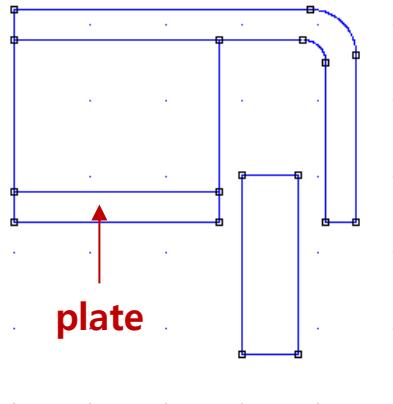
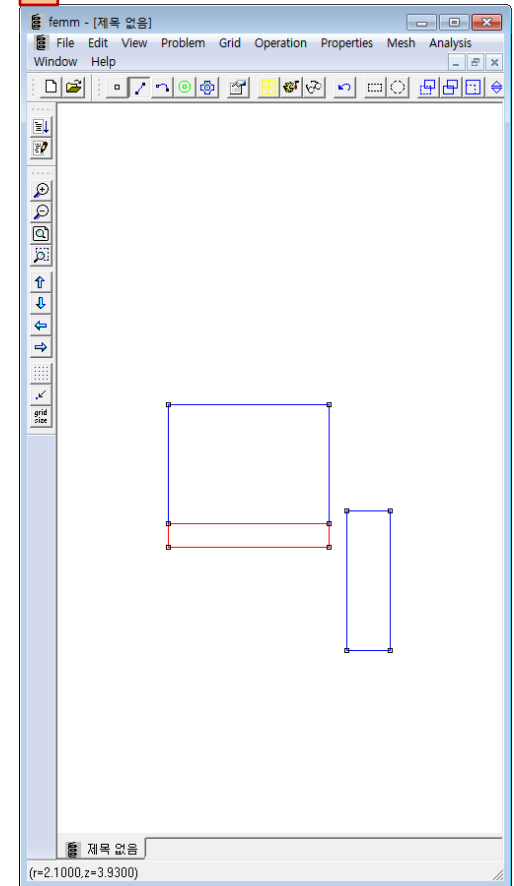
1. Toolbar > Steel 버튼 클릭
2. Steel Name 입력 : "plate"
3. Face Type : RECTANGLE 선택
4. Plate 형상 입력
  - ✓ 자석 위치 : Base\_X 0, Base\_Y 0.2
  - ✓ 좌하 점 : X 0, Y 0 (상대 좌표)
  - ✓ 우상 점 : X 1.35, Y 0.2 (상대 좌표)
5. 화면 조정 : Fit All 버튼 사용
6. OK 버튼 클릭
7. 형상 확인 (FEMM 창)



2~5



6



# Yoke 생성

1. Toolbar > Steel 버튼 클릭



2. Steel Name 입력 : "yoke"

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

2~3

The dialog box 'Add Steel' is shown. The 'Steel Name' field contains 'yoke'. The 'Face Type' dropdown is set to 'POLYGON'. The 'Base\_X' field is 0.0 and 'Base\_Y' is 0.0. Below is a table with 8 rows for points. The 'No.' column contains 1 through 8. The 'X' and 'Y' columns are empty. The 'Arc' and 'Dir' columns have checkboxes. The 'Del' column has a 'D' button. The 'Add' column has an 'A' button. At the bottom are buttons for 'Redraw', 'Fit All', 'Reserved', 'OK', and 'Cancel'.

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

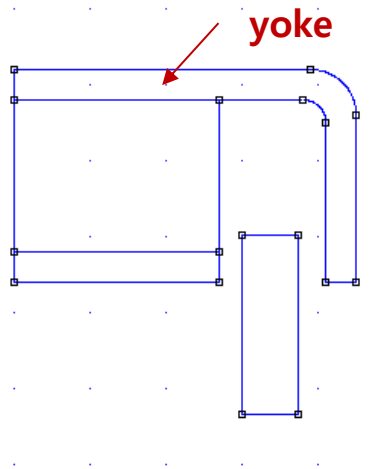
4~5

The dialog box 'Add Steel' is shown. The 'Steel Name' field contains 'yoke'. The 'Face Type' dropdown is set to 'POLYGON'. The 'Base\_X' field is 0.0 and 'Base\_Y' is 0.2. Below is a table with 8 rows for points. The 'No.' column contains 1 through 8. The 'X' and 'Y' columns contain values. The 'Arc' and 'Dir' columns have checkboxes. The 'Del' column has a 'D' button. The 'Add' column has an 'A' button. At the bottom are buttons for 'Redraw', 'Fit All', 'Reserved', 'OK', and 'Cancel'.

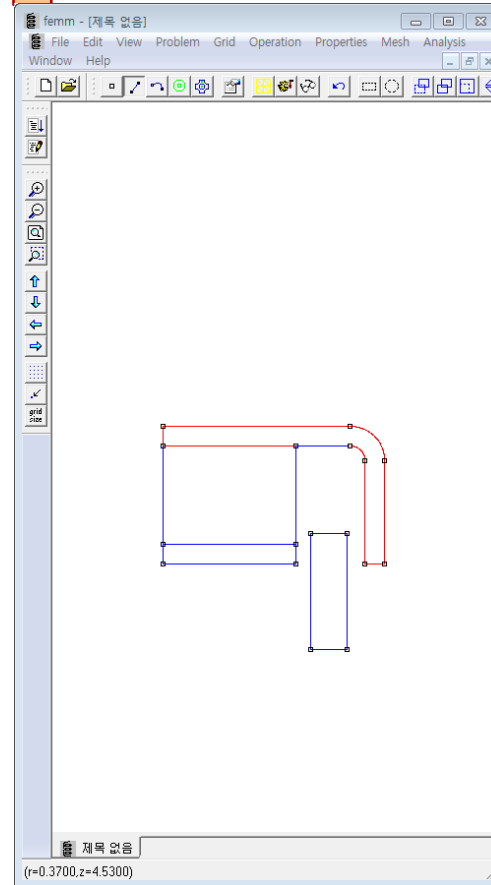
No.	X	Y	Arc	Dir	Del	Add
1	0	1.4	<input type="checkbox"/>	<input type="checkbox"/>	D	
2	0	1.2	<input type="checkbox"/>	<input type="checkbox"/>	D	
3	1.9	1.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D	
4	2.05	1.05	<input type="checkbox"/>	<input type="checkbox"/>	D	
5	2.05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

# Yoke 생성

## 7. 형상 확인 (FEMM 창)



6

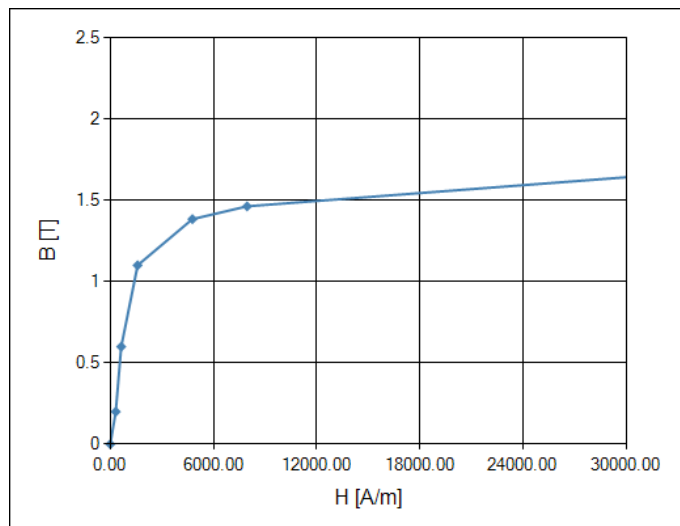


# Plate, Yoke 설정

## 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"

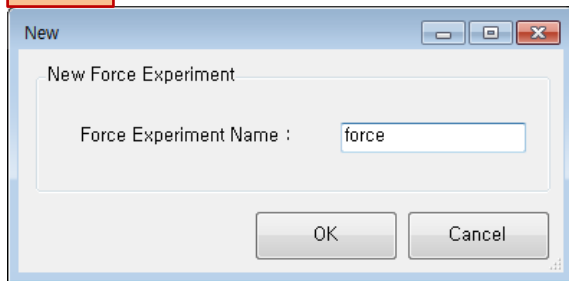
3. OK 버튼 클릭

4. 자기력 가상실험 설정

✓ Voltage : 2.5 V

5. 자기력 가상실험 실행

2~3



4

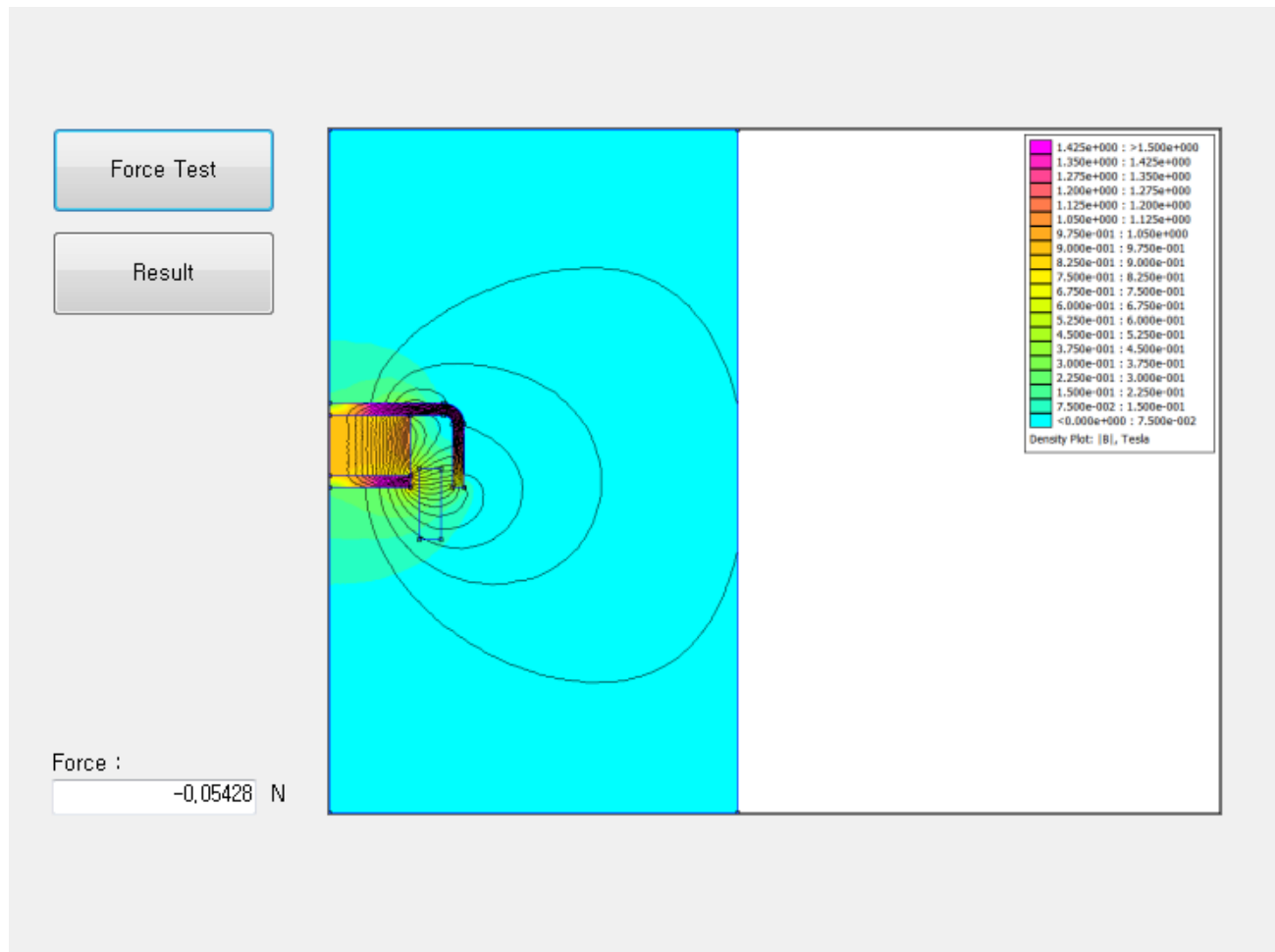
Common Fields	
Node Name	force
Input Fields	
Voltage [V]	2.5
Max. Current [A]	0.15875
Stroke Fields	
Moving Stroke [mm]	0

5



# 자기력 가상실험 결과

1. Force : -0.05428 N



# 변위-자기력 가상실험

1. Toolbar > Stroke 버튼 클릭



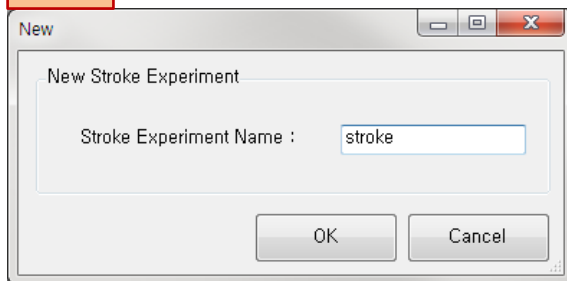
2. Experiment Name 입력 : "stroke"

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



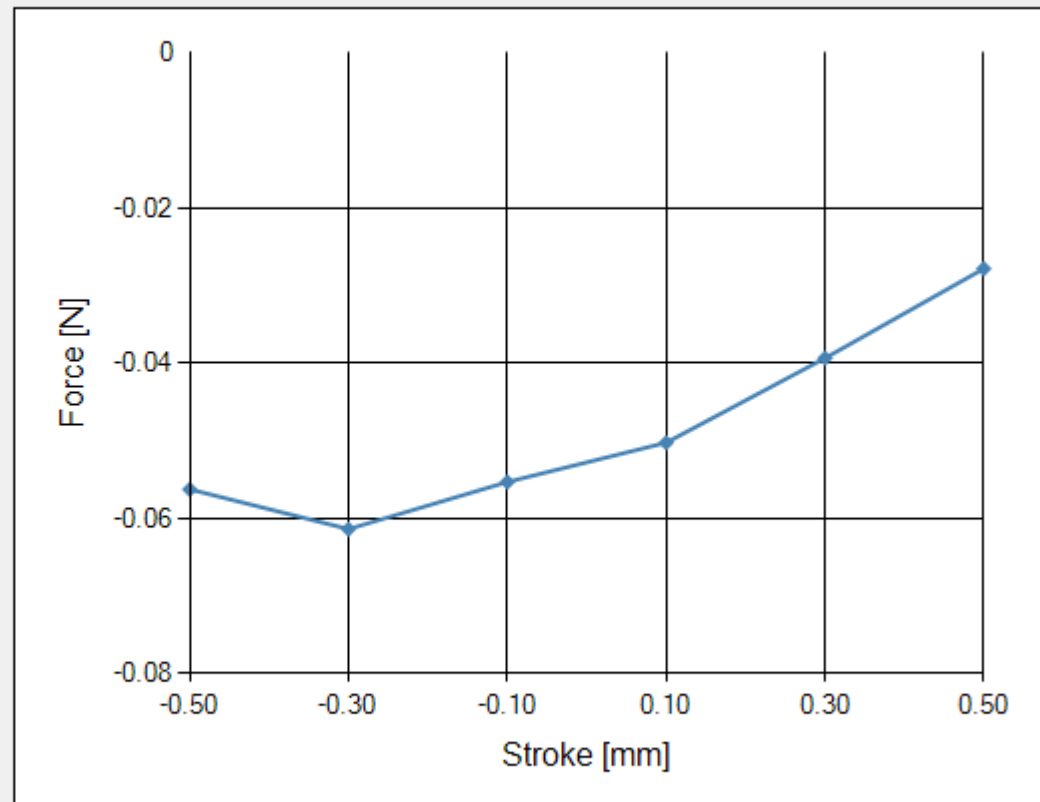
# 변위-자기력 가상실험 결과

1. Information View / Stroke Test 버튼을 클릭

1

Stroke Test

Result



# 전류-자기력 가상실험

1. Toolbar > Current 버튼 클릭



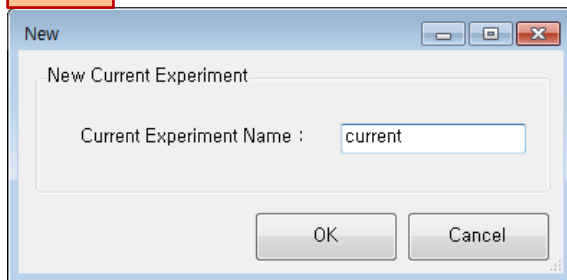
2. Experiment Name 입력 : "current"

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

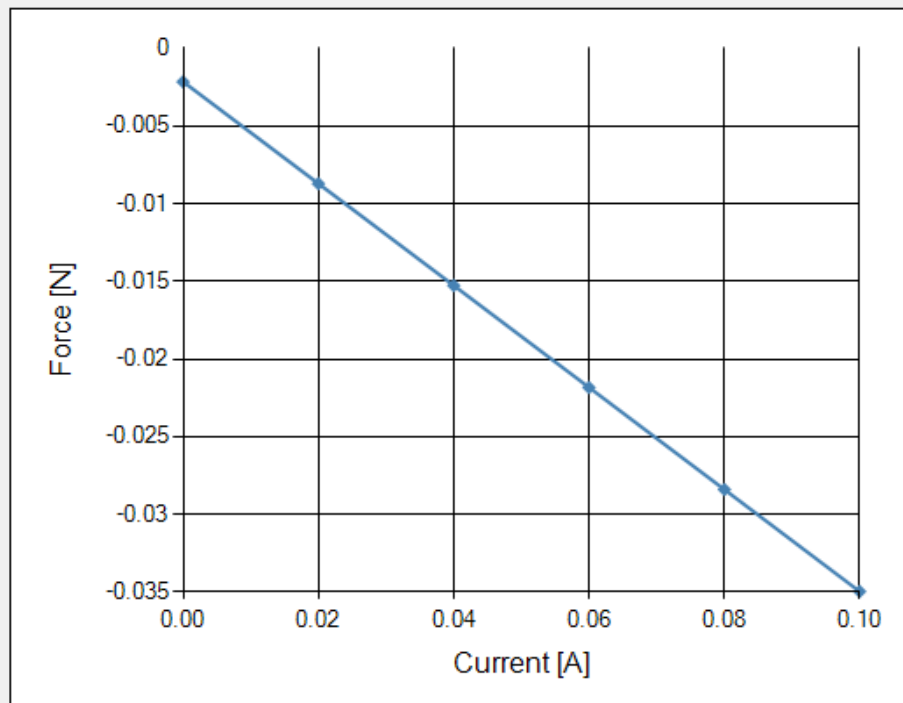
# 전류-자기력 가상실험 결과

1. Information View / Current Test 버튼을 클릭

1

Current Test

Result





**– Thank You –**

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