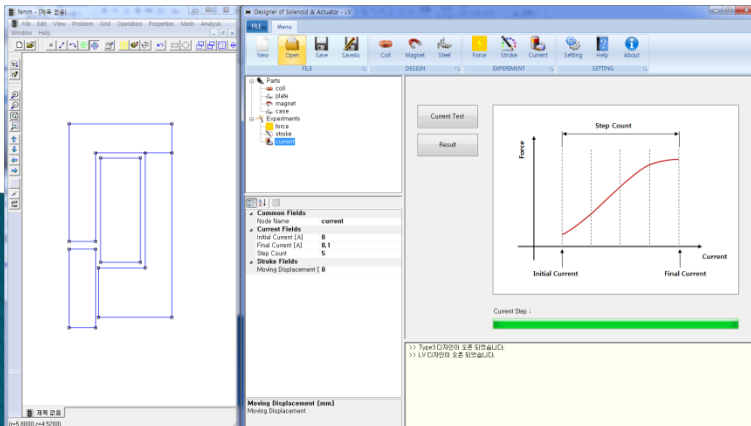


DoSA User Manual

Example of Solenoid

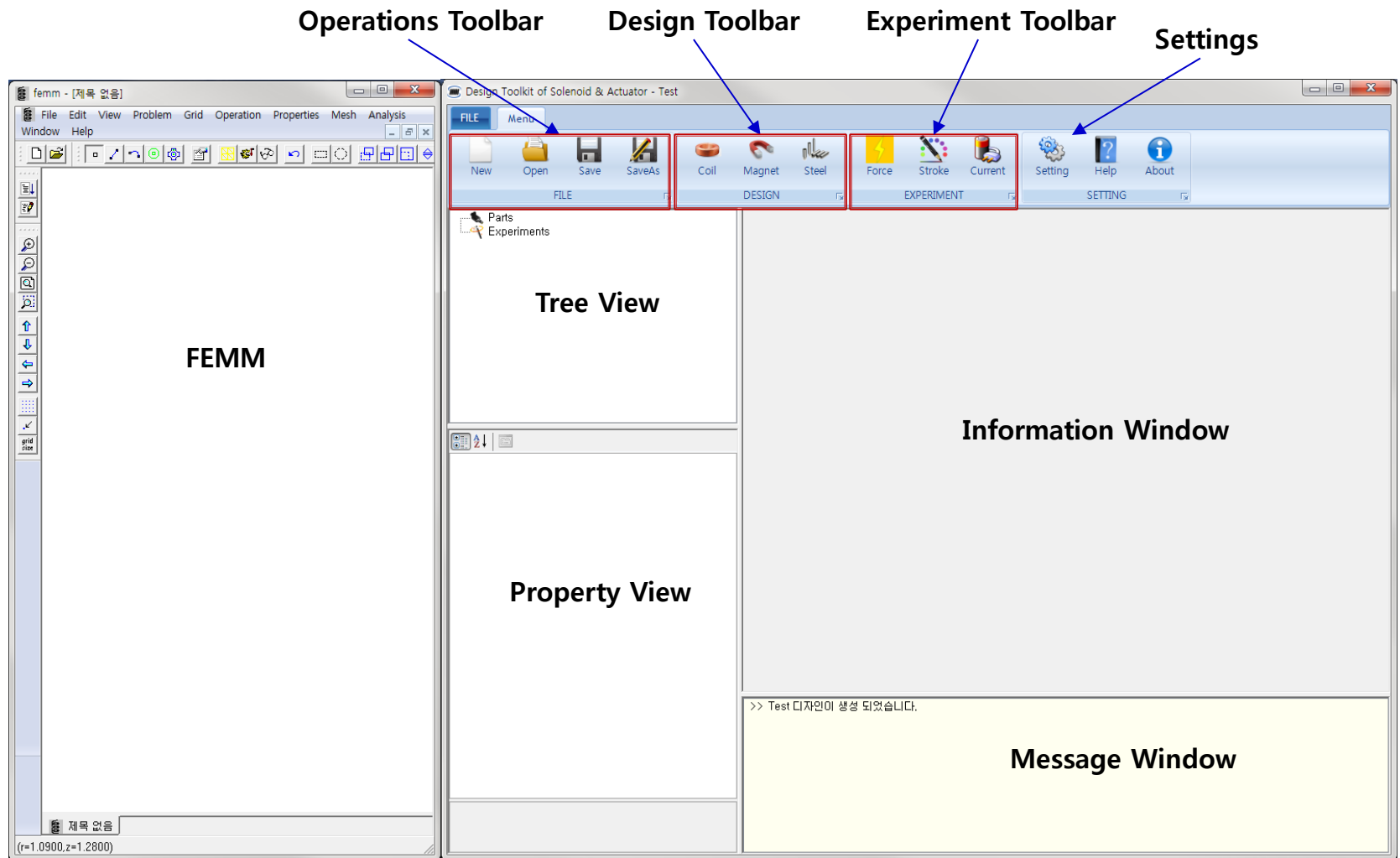
2018-04-21

GiTae Kweon (zgitae@gmail.com)



DoSA Structure

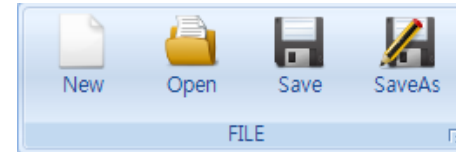
Program Structure



Toolbar

1. Operations

- ✓ New : Create a new design
- ✓ Open : Open previous design
- ✓ Save : Save the design
- ✓ SaveAs : Save in different name



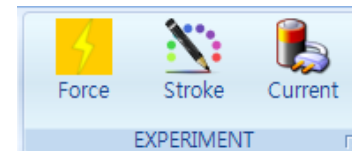
2. Design

- ✓ Coil : Add a coil and specification design
- ✓ Magnet : Add a magnet and determine specifications
- ✓ Steel : Add a steel and determine specifications



3. Experiment

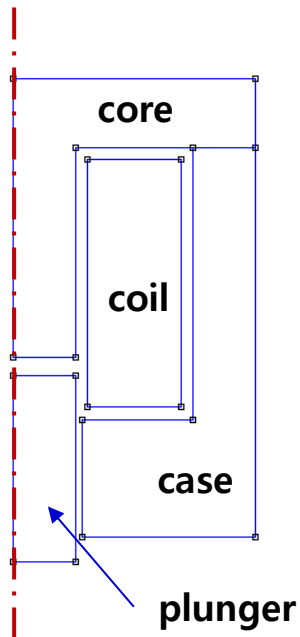
- ✓ Force : Magnetic force estimation for driving part
- ✓ Stroke : Magnetic force estimation for each stroke
- ✓ Current : Magnetic force estimation for each current



Analysis Model

Analysis Model

1. Model Shape



2. Product Specifications

가. Coil Turns

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

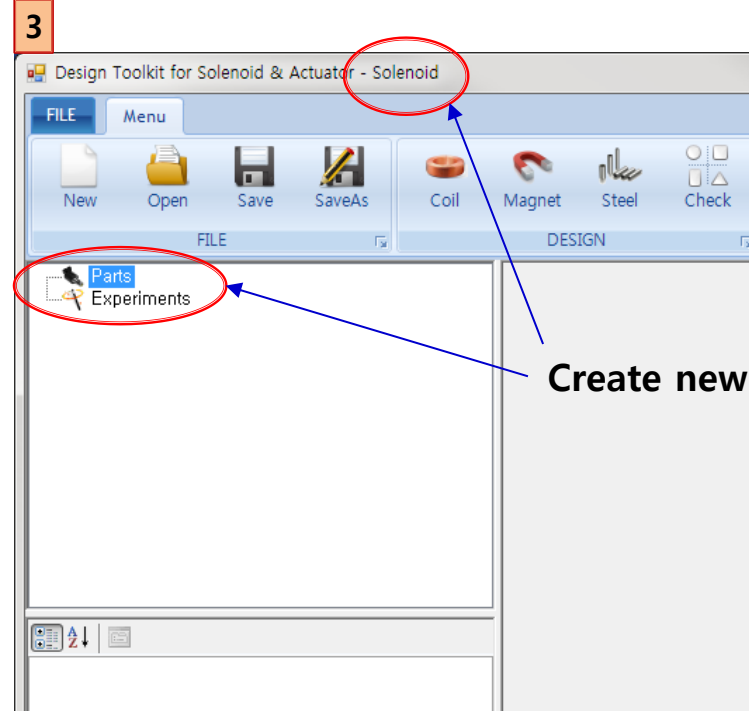
나. Power

- Voltage : 14.5V

(Work Example Files : DoSA Install Directory > Samples > Solenoid)

New design

1. Toolbar > Click New Button
2. Design Name : "Solenoid"
3. Click OK



Create new design

Parts Design

Add Coil

1. Toolbar > Click Coil button



2. Coil Name : "coil"

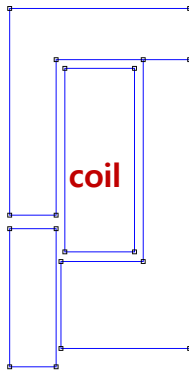
3. Coil Shape Input

- ✓ Coil Location : Base_X 4.8, Base_Y -2
- ✓ Left-Down Point : X 0, Y 0
(Relative Coordinates)
- ✓ Right-Upper Point : X 6, Y 16
(Relative Coordinates)

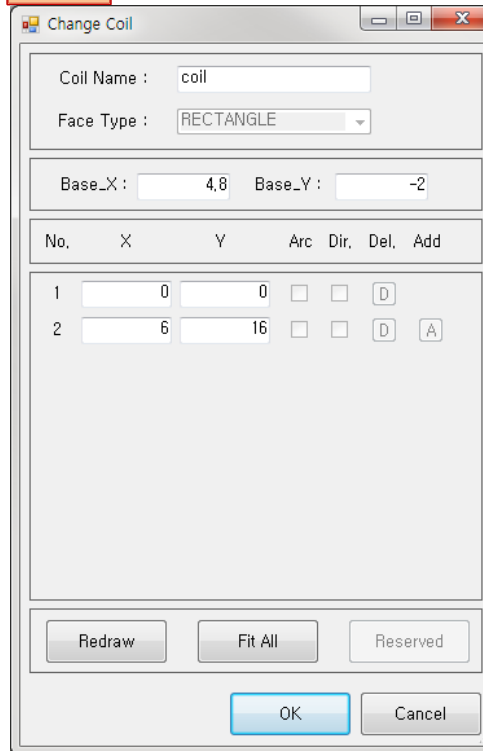
4. Screen Adjustment : Use Fit All Button

5. Click OK Button

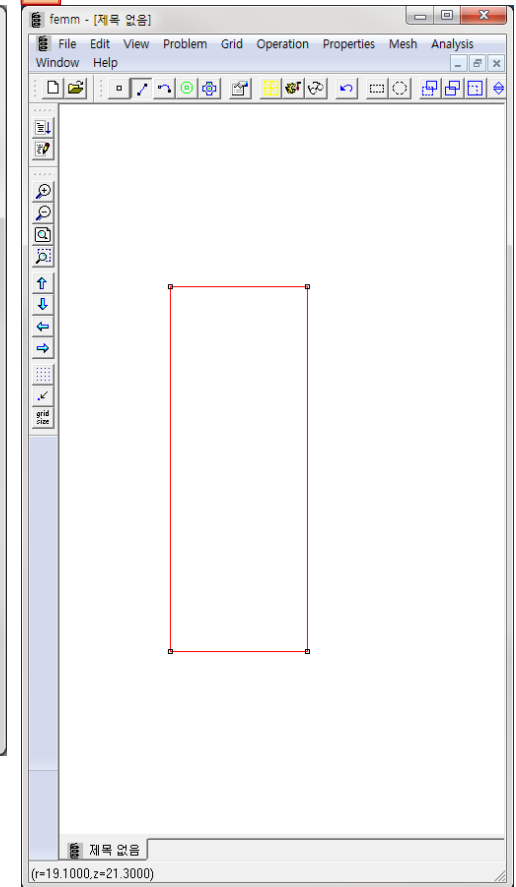
6. Check Shape (FEMM Window)



2~4



5



Coil Design

1. Input Coil specifications

- ✓ Part Material : Copper
- ✓ Current Direction : IN (Inner Direction)
- ✓ Moving Parts : FIXED (Fixed Parts)
- ✓ Coil Wire Grade : Enameled_IEC_Grade_2
- ✓ Copper Diameter : 0.27 mm
- ✓ Horizontal Coefficient : 0.9 (Enameled Type)
- ✓ Vertical Coefficient : 0.98 (Enameled Type)
- ✓ Resistance Coefficient : 1 (Enameled Type)

2. Calculate the coil specification

- ✓ Click "Coil Design" button

2

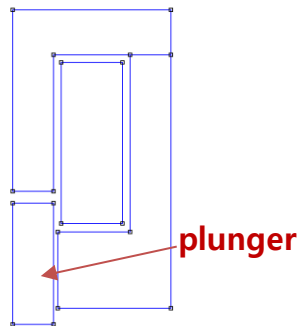
Coil Design

1

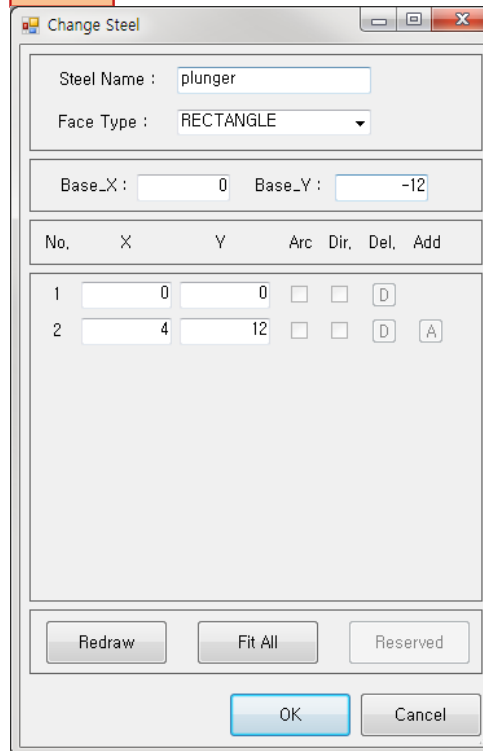
Common Fields	
Node Name	coil
Specification Fields	
Part Material	Copper
Current Direction	IN
Moving Parts	FIXED
Calculated Fields	
Coil Turns	1040
Coil Resistance [Ω]	15,20945
Coil Layers	20
Turns of One Layer	52
Design Fields (optional)	
Coil Wire Grade	Enameled_IEC_Grade_2
Inner Diameter [mm]	9,6
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

Add plunger

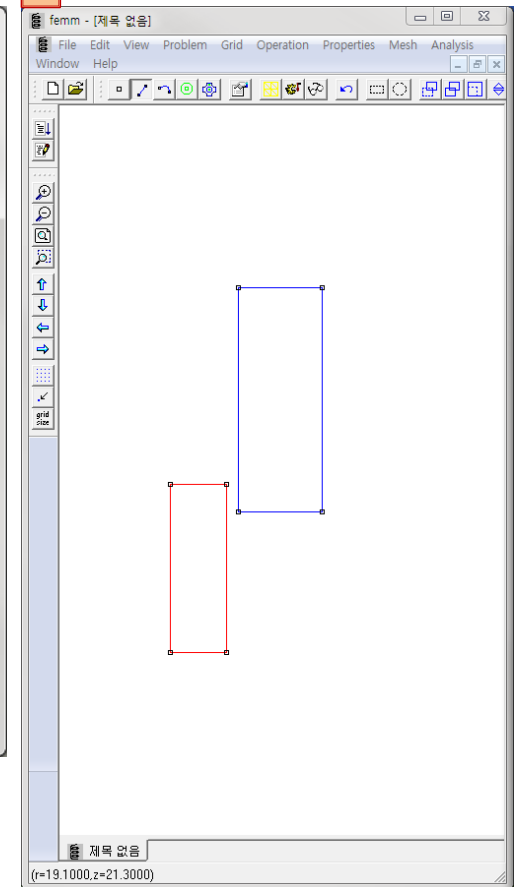
1. Toolbar > Click Steel Button
2. Steel Name : "plunger"
3. Face Type : RECTANGLE
4. Plunger Shape
 - ✓ Plunger Location : Base_X 0, Base_Y -12
 - ✓ Left-Down Point : X 0, Y 0
(Relative Coordinates)
 - ✓ Right-Upper Point : X 4, Y 12
(Relative Coordinates)
5. Screen Adjustment : Use Fit All Button
6. Click OK Button
7. Check Shape (FEMM Window)



2~5



6

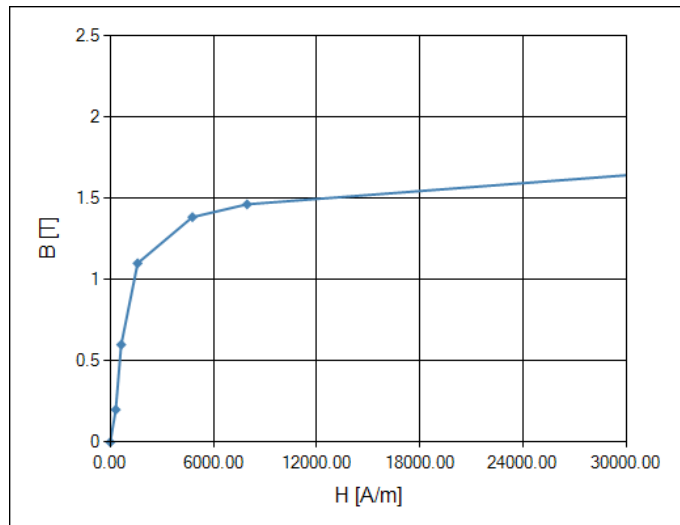


Plunger Settings

8. Plunger setting

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

[BH Curve]



1

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

Add core

1. Toolbar > Click Steel Button



2. Steel Name : "core"

3. Add input lines of point : Click 'A' button

4. Core Shape

✓ Core Location : Base_X 0, Base_Y 1.2

✓ 1 point : X 0, Y 0

✓ 2 point : X 4, Y 0

✓ 3 point : X 4, Y 13.6

✓ 4 point : X 15.6, Y 13.6

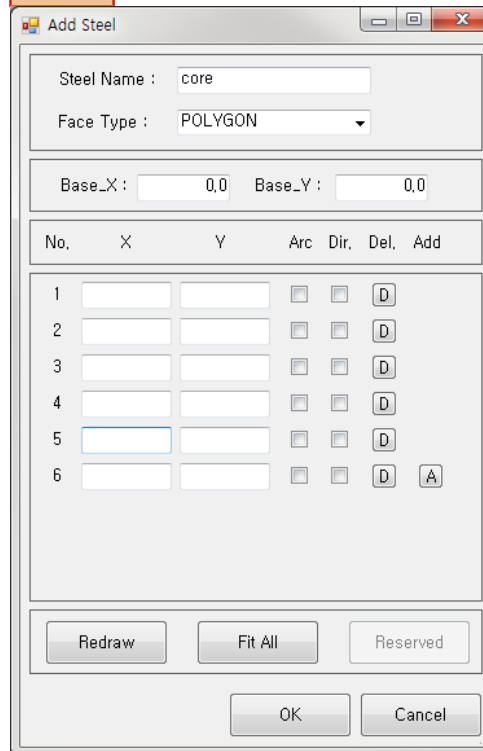
✓ 5 point : X 15.6, Y 18

✓ 6 point : X 0, Y 18

5. Screen Adjustment : Use Fit All Button

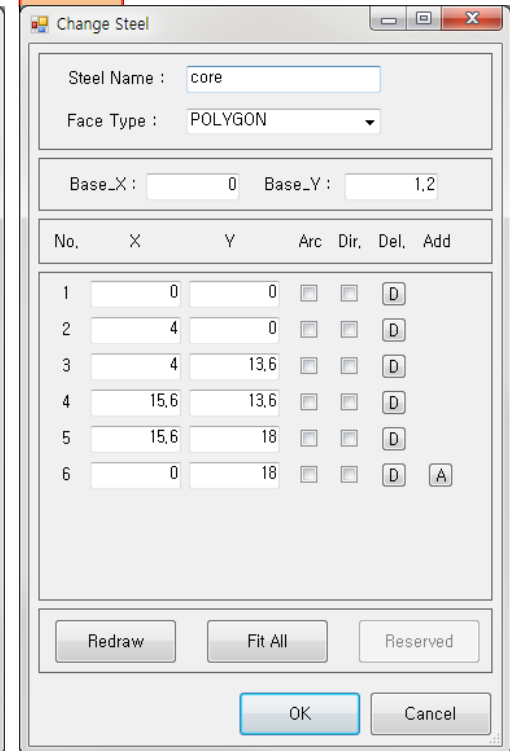
6. Click OK Button

2~3

The "Add Steel" dialog box is shown. It has a title bar with standard window controls. The "Steel Name" field contains "core". The "Face Type" dropdown is set to "POLYGON". Below these are input fields for "Base_X" (0.0) and "Base_Y" (0.0). A table with 6 rows and 7 columns (No., X, Y, Arc, Dir, Del, Add) is present. The "Add" column contains buttons labeled 'D' for rows 1-5 and 'D' with a small 'A' icon for row 6. At the bottom are buttons for "Redraw", "Fit All", "Reserved", "OK", and "Cancel".

No.	X	Y	Arc	Dir	Del	Add
1						D
2						D
3						D
4						D
5						D
6						D A

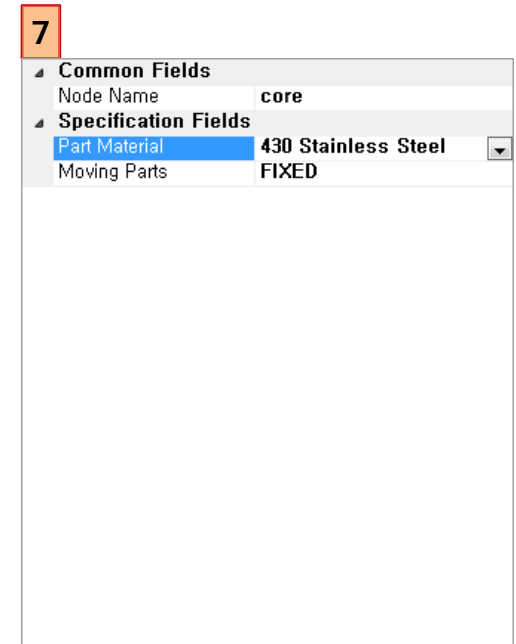
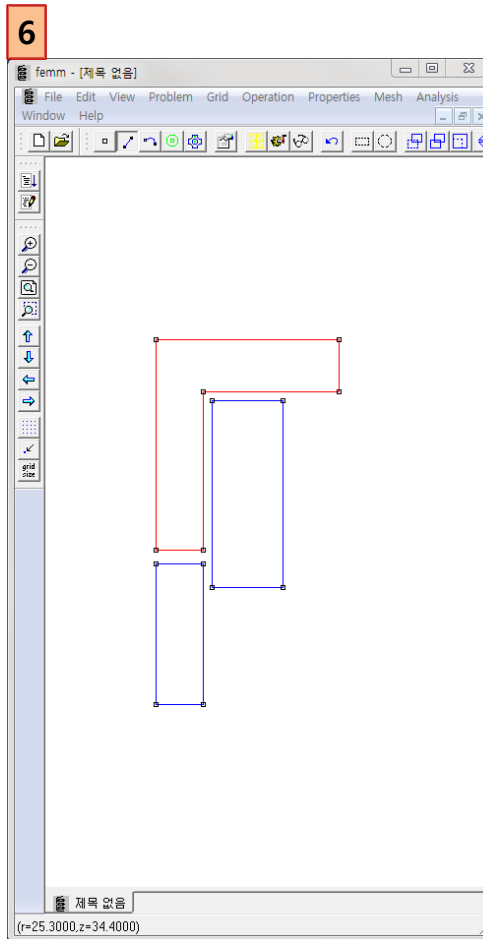
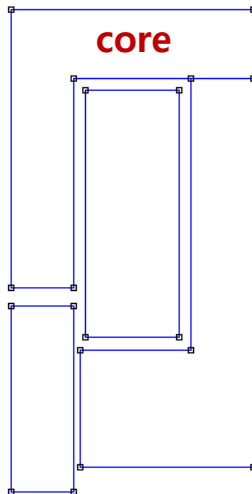
4~5

The "Change Steel" dialog box is shown. It has a title bar with standard window controls. The "Steel Name" field contains "core". The "Face Type" dropdown is set to "POLYGON". Below these are input fields for "Base_X" (0) and "Base_Y" (1.2). A table with 6 rows and 7 columns (No., X, Y, Arc, Dir, Del, Add) is present. The "X" and "Y" columns contain the values: (0, 0), (4, 0), (4, 13.6), (15.6, 13.6), (15.6, 18), and (0, 18). The "Add" column contains buttons labeled 'D' for rows 1-5 and 'D' with a small 'A' icon for row 6. At the bottom are buttons for "Redraw", "Fit All", "Reserved", "OK", and "Cancel".

No.	X	Y	Arc	Dir	Del	Add
1	0	0				D
2	4	0				D
3	4	13.6				D
4	15.6	13.6				D
5	15.6	18				D
6	0	18				D A

Core Settings

7. Check Shape (FEMM Window)
8. Core setting
 - ✓ Part Material : 430 Stainless Steel
 - ✓ Moving Parts : FIXED



Add case

1. Toolbar > Click Steel Button



2. Steel Name : "case"

3. Add input lines of point : Click 'A' button

4. Case Shape

✓ Case Location : Base_X 4.4, Base_Y -10.4

✓ 1 point : X 0, Y 0

✓ 2 point : X 11.2, Y 0

✓ 3 point : X 11.2, Y 25.2

✓ 4 point : X 7.4, Y 25.2

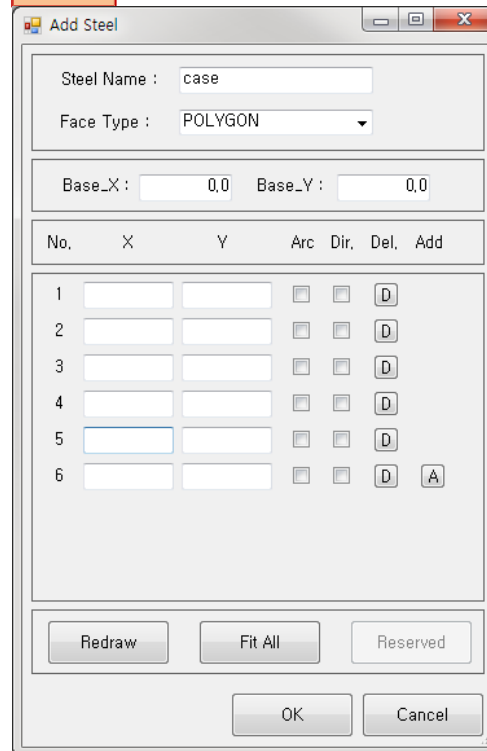
✓ 5 point : X 7.4, Y 7.6

✓ 6 point : X 0, Y 7.6

5. Screen Adjustment : Use Fit All Button

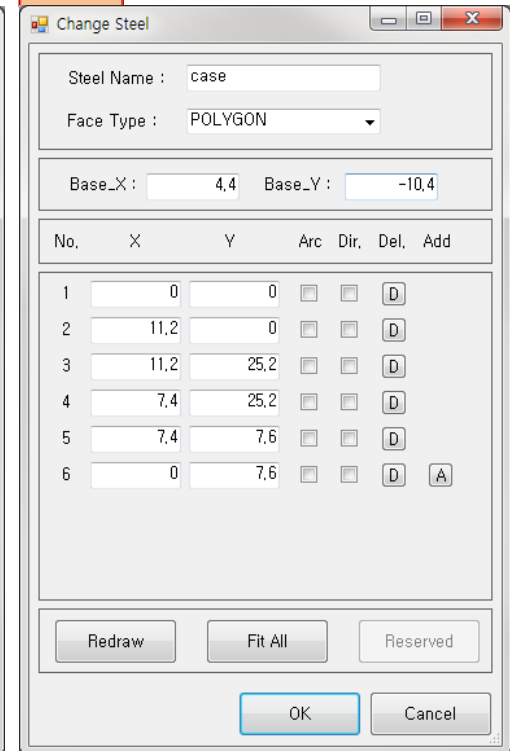
6. Click OK Button

2~3

The "Add Steel" dialog box is shown. It has a title bar with standard window controls. The "Steel Name" field contains "case". The "Face Type" dropdown is set to "POLYGON". The "Base_X" field is 0.0 and the "Base_Y" field is 0.0. Below these is a table with 6 rows and 6 columns. The columns are labeled "No.", "X", "Y", "Arc", "Dir.", and "Del.". The "Add" column contains a button labeled "A". The "Add" button is highlighted. At the bottom are buttons for "Redraw", "Fit All", "Reserved", "OK", and "Cancel".

No.	X	Y	Arc	Dir.	Del.	Add
1						D
2						D
3						D
4						D
5						D
6						D A

4~5

The "Change Steel" dialog box is shown. It has a title bar with standard window controls. The "Steel Name" field contains "case". The "Face Type" dropdown is set to "POLYGON". The "Base_X" field is 4.4 and the "Base_Y" field is -10.4. Below these is a table with 6 rows and 6 columns. The columns are labeled "No.", "X", "Y", "Arc", "Dir.", and "Del.". The "Add" column contains a button labeled "A". The "Add" button is highlighted. At the bottom are buttons for "Redraw", "Fit All", "Reserved", "OK", and "Cancel".

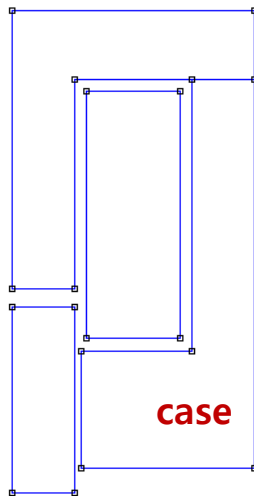
No.	X	Y	Arc	Dir.	Del.	Add
1	0	0				D
2	11.2	0				D
3	11.2	25.2				D
4	7.4	25.2				D
5	7.4	7.6				D
6	0	7.6				D A

Case Setting

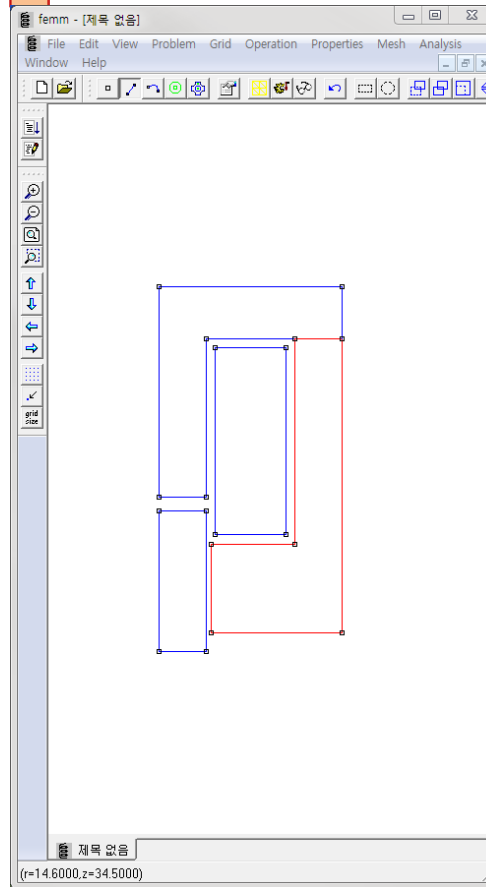
7. Check Shape (FEMM Window)

8. Case setting

- ✓ Part Material : 1010 Steel
- ✓ Moving Parts : FIXED



6



7

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

Virtual Experiments

Experiment of magnetic force

1. Toolbar > Click Force Button



2. Force Experiment Name : "force"

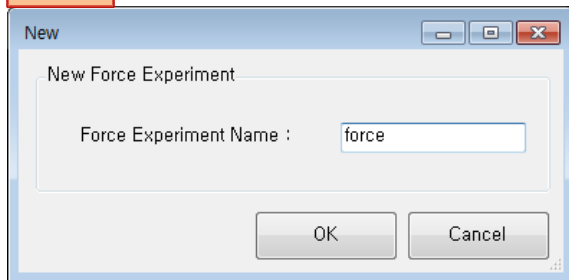
3. Click OK Button

4. Setting of magnetic force experiment

✓ Voltage : 14.5 V

5. Click "Force Test" Button

2~3



4

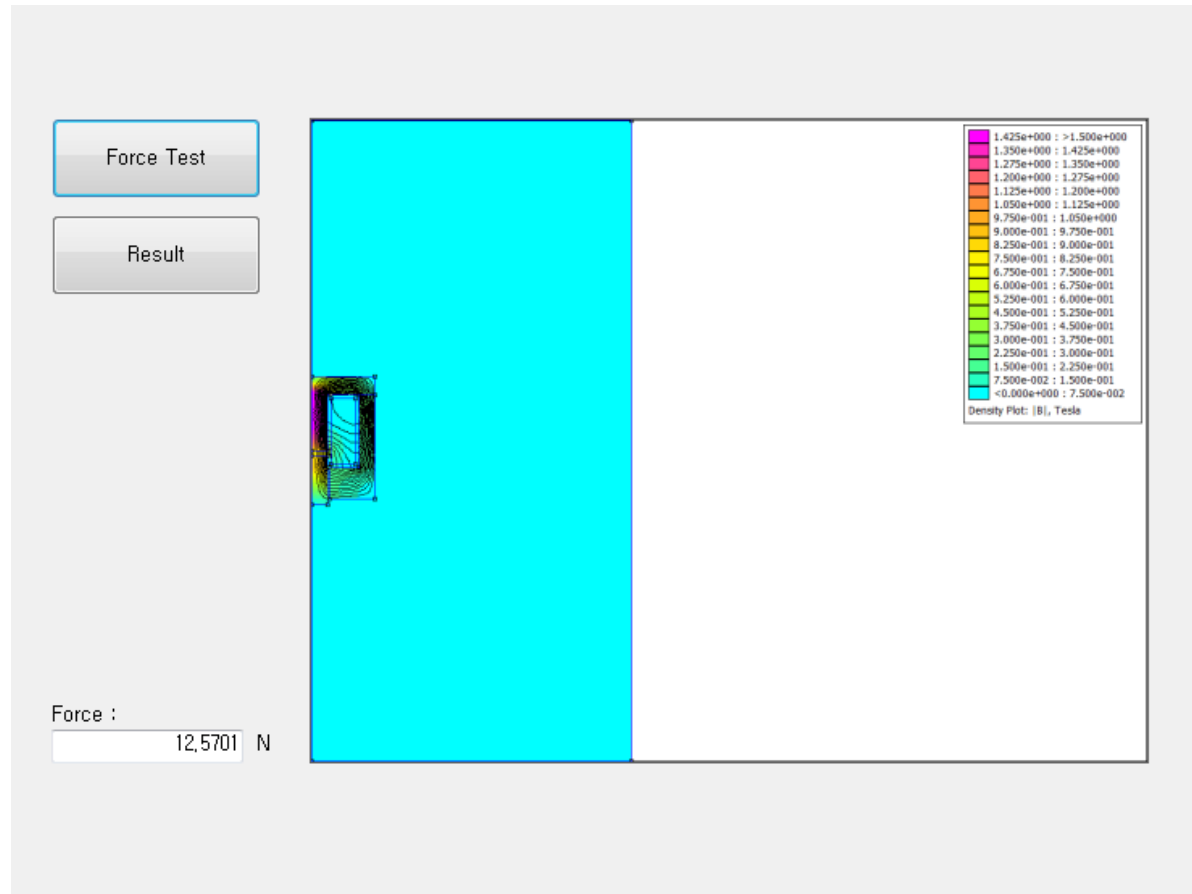
Common Fields	
Node Name	force
Input Fields	
Voltage [V]	14.5
Max. Current [A]	0.95335
Stroke Fields	
Moving Stroke [mm]	0

5



Results of magnetic force

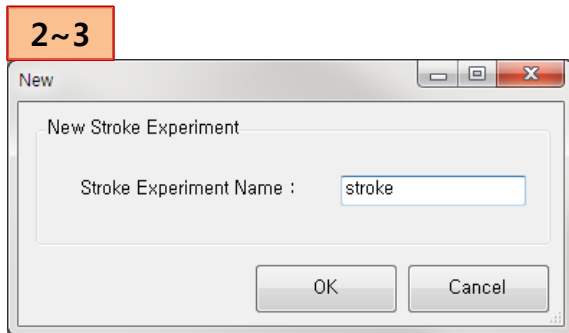
1. Force : 12.57 N



Experiment of displacement–magnetic force



1. Toolbar > Click Stroke Button
2. Stroke Experiment Name : "stroke"
3. Click OK Button
4. Settings of the experiment
 - ✓ Voltage : 14.5 V
 - ✓ Initial Stroke : 0.0 mm
 - ✓ Final Stroke : 1.0 mm
 - ✓ Step Count : 5

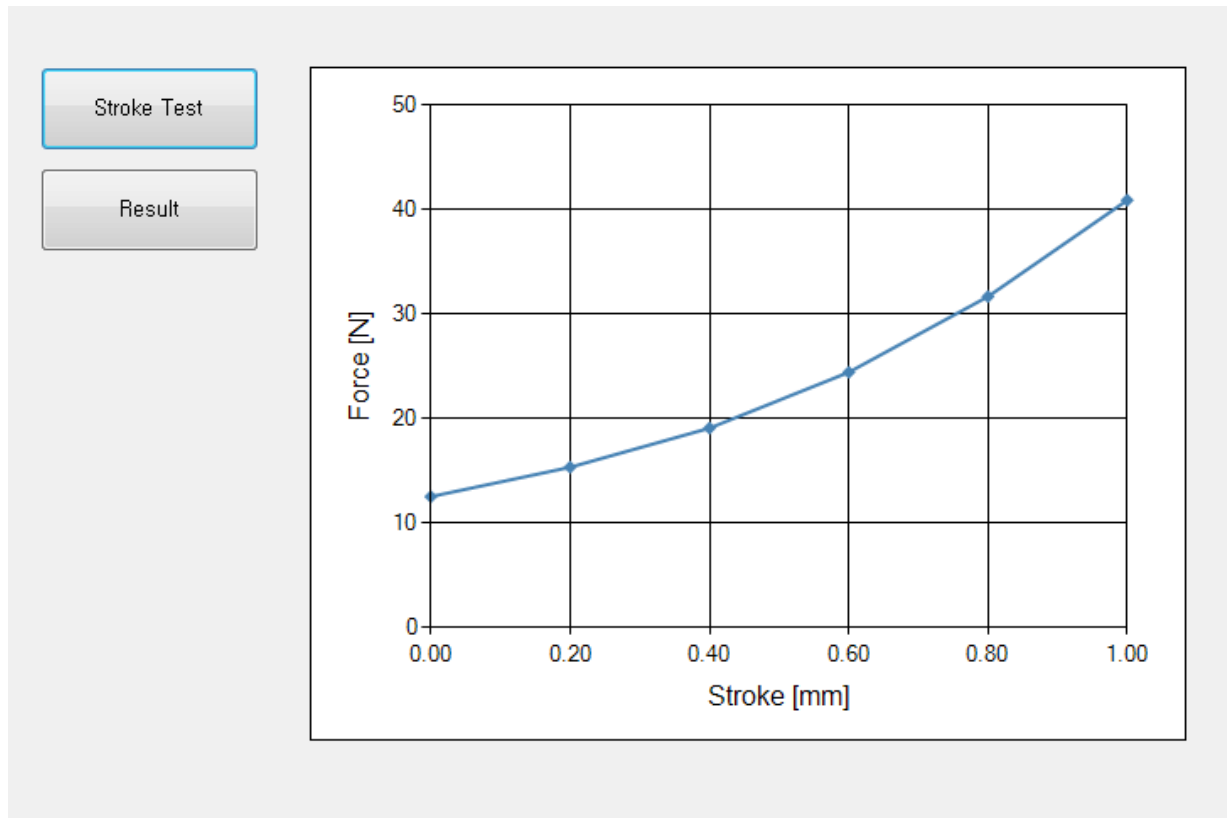


4

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

Results of displacement–magnetic force

5. Information View > Click "Stroke Test" Button

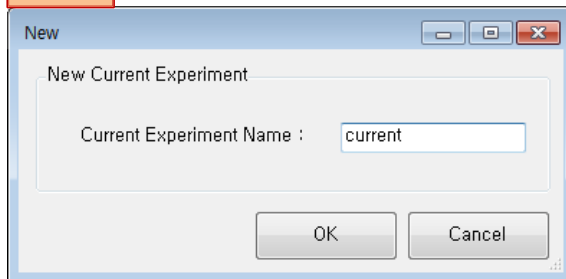


Experiment of current-magnetic force



1. Toolbar > Click Current Button
2. Current Experiment Name : "current"
3. Click OK Button
4. Experiment Settings
 - ✓ Initial Current : 0.0 A
 - ✓ Final Current : 1.5 A
 - ✓ Step Count : 5

2~3

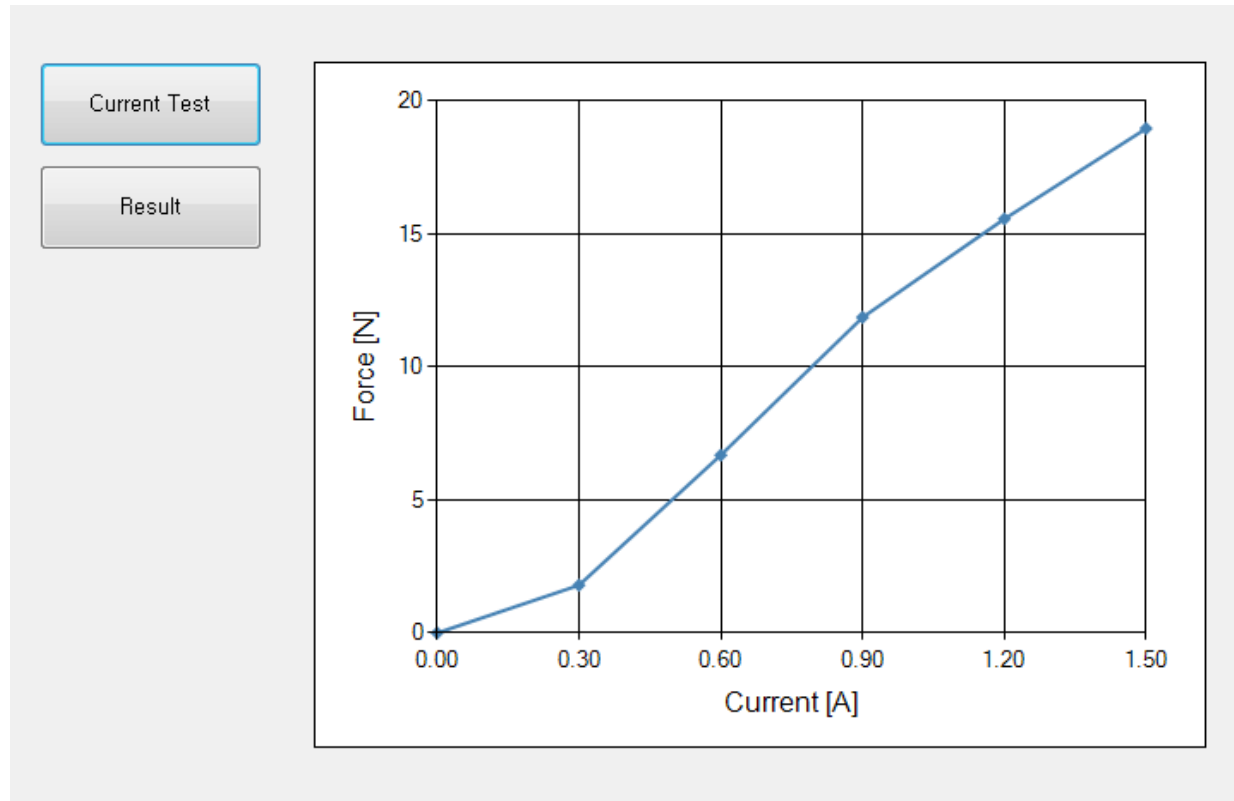


4

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

Results of current-magnetic force

5. Information View > Click "Current Test" Button



Thank You