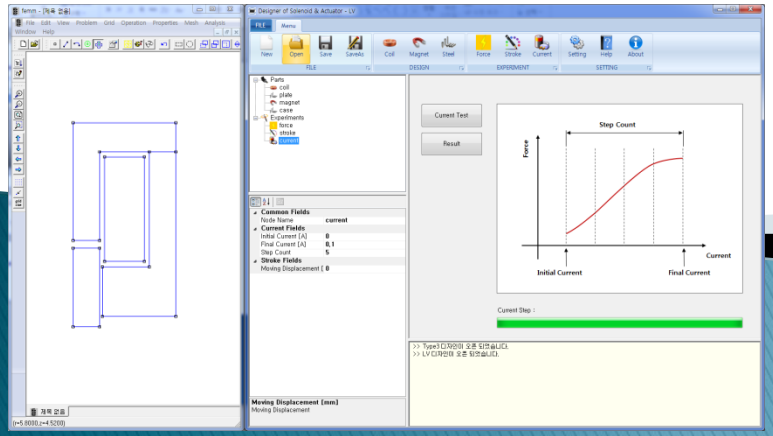
DoSA-2D User Manual

Solenoid Example

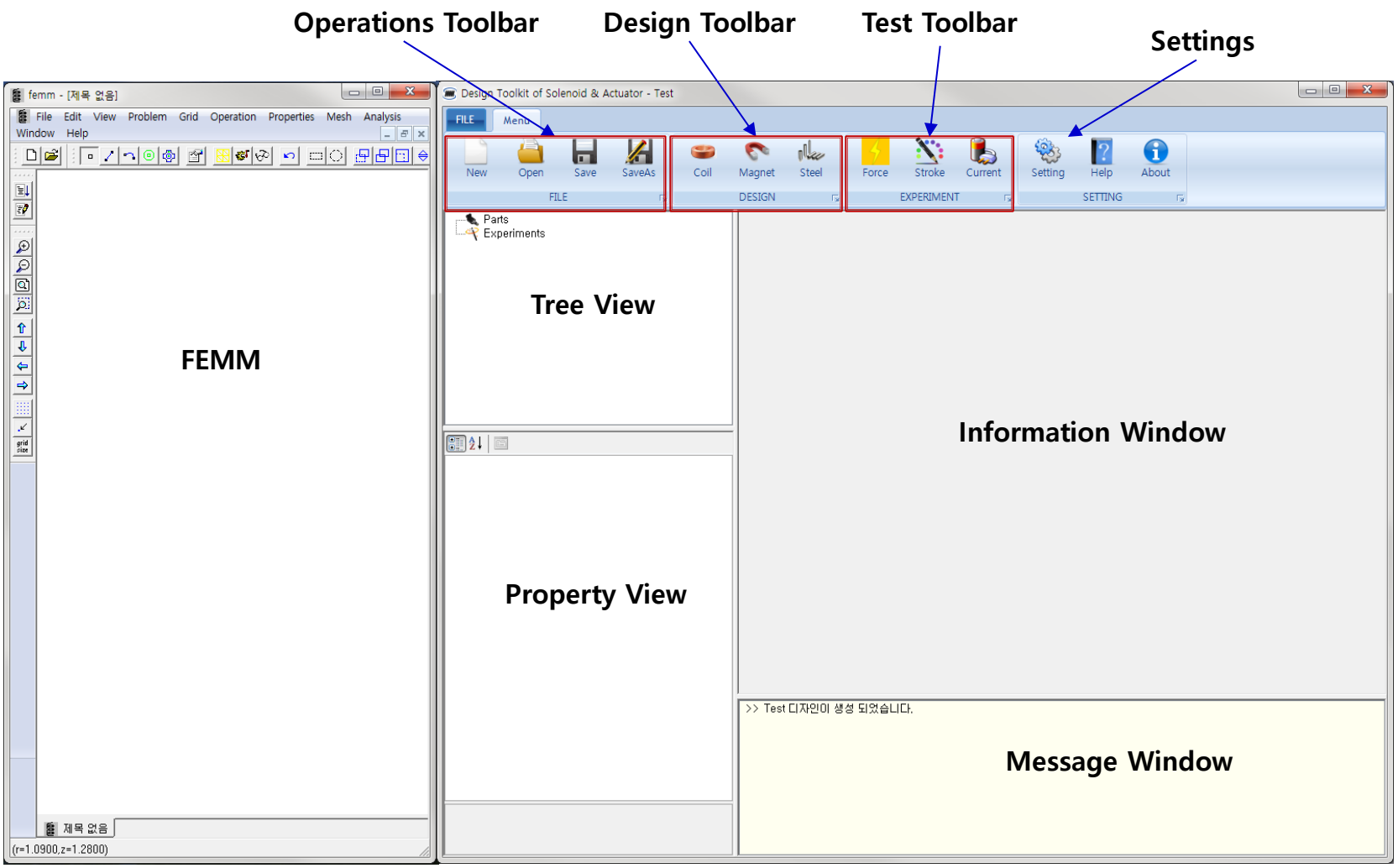


2022-03-19

GiTae Kweon (zgitae@gmail.com)

DoSA Structure

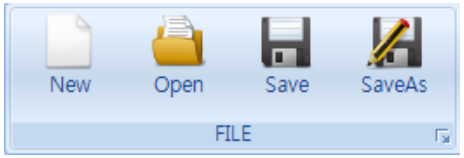
Program Structure



Toolbar

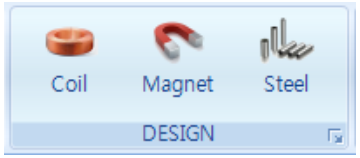
1. Operations

- ✓ 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



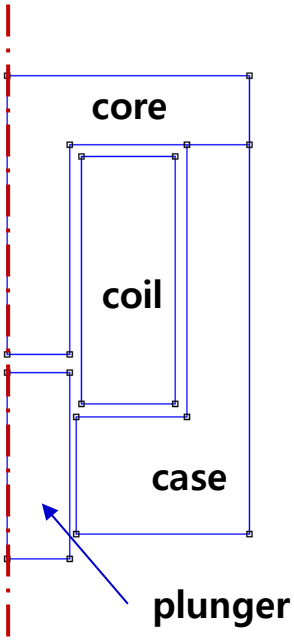
3. Virtual Test

- ✓ Force : Magnetic force estimation
- ✓ 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

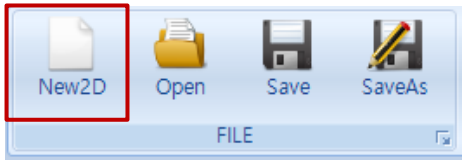
- Voltage : 14.5V

(Work Example Files : DoSA-2D Install Directory > Samples > Solenoid)

New design

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

1



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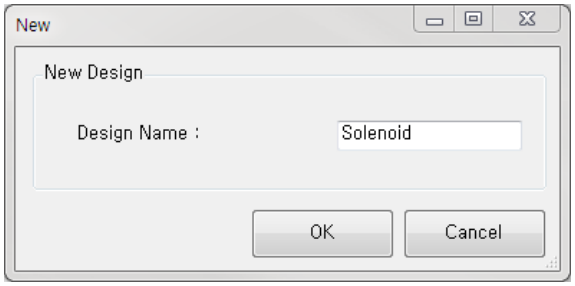

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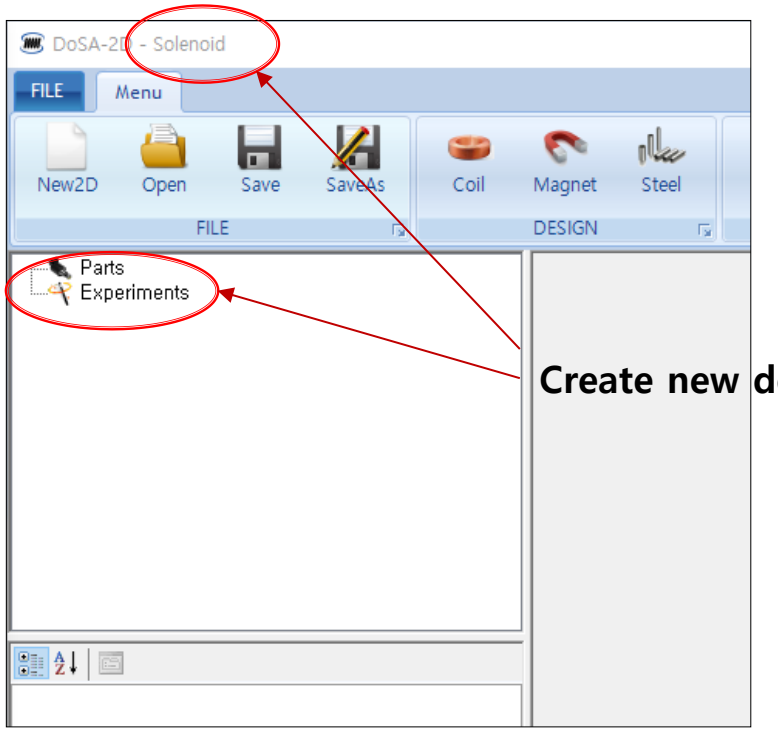
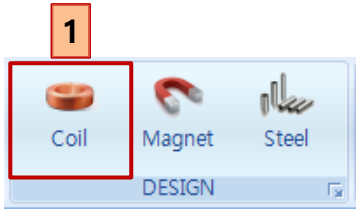
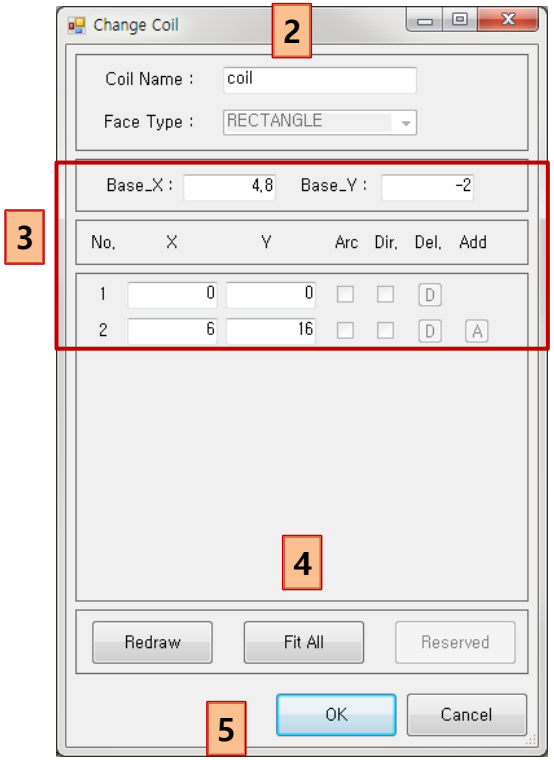


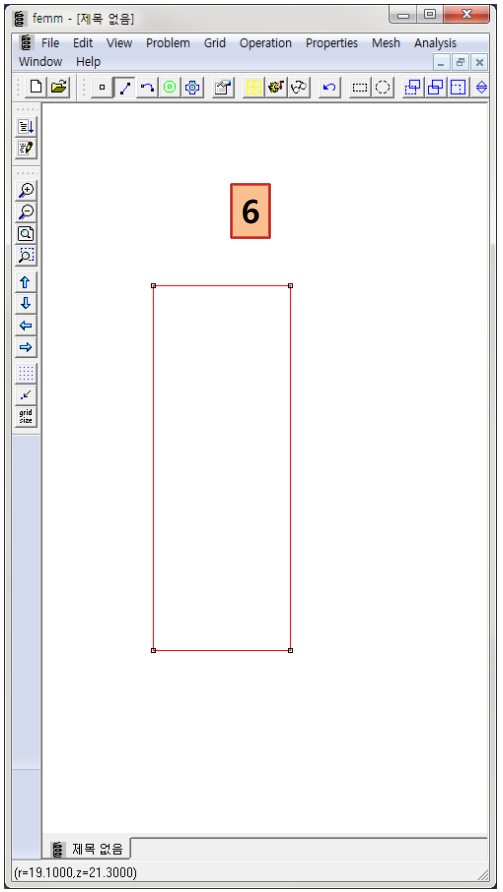
Parts Design

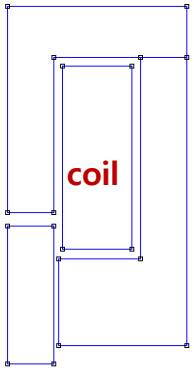
Add a Coil

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)









Coil Design

1. Input Coil specifications
   - ✓ Copper Diameter : 0.27
   - ✓ Horizontal Coefficient : 0.9 (Enameled Type)
   - ✓ Vertical Coefficient : 0.98 (Enameled Type)
   - ✓ Resistance Coefficient : 1 (Enameled Type)

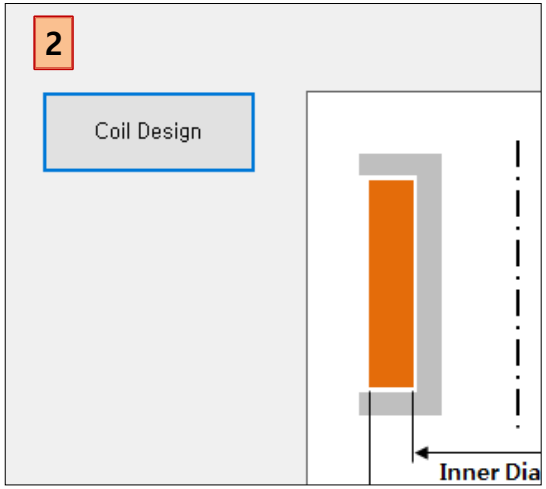
2. Calculate the coil specification
   - ✓ Click "Coil Design" button

3. Check the coil specification

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**

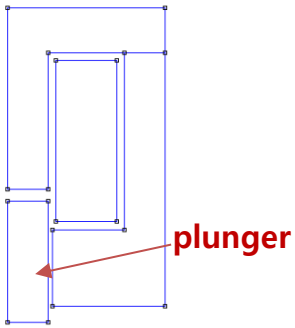
1

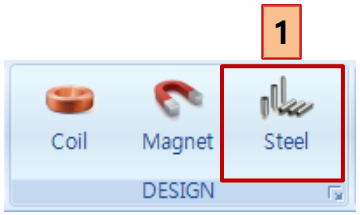
3

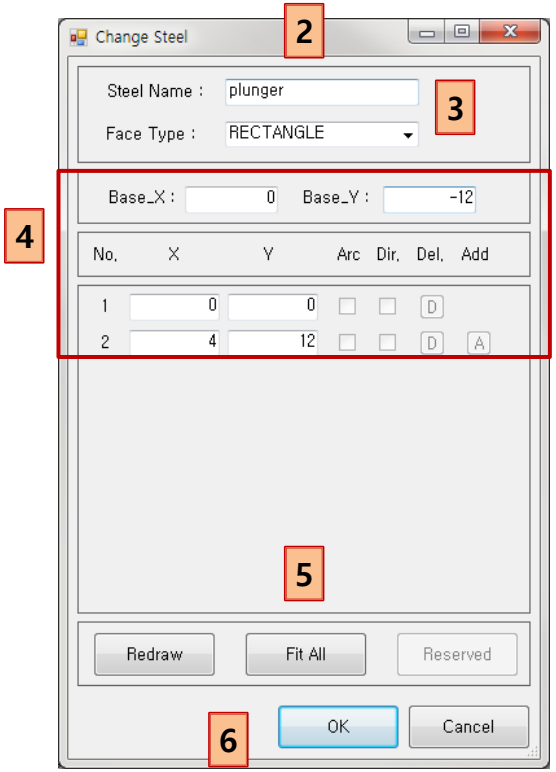


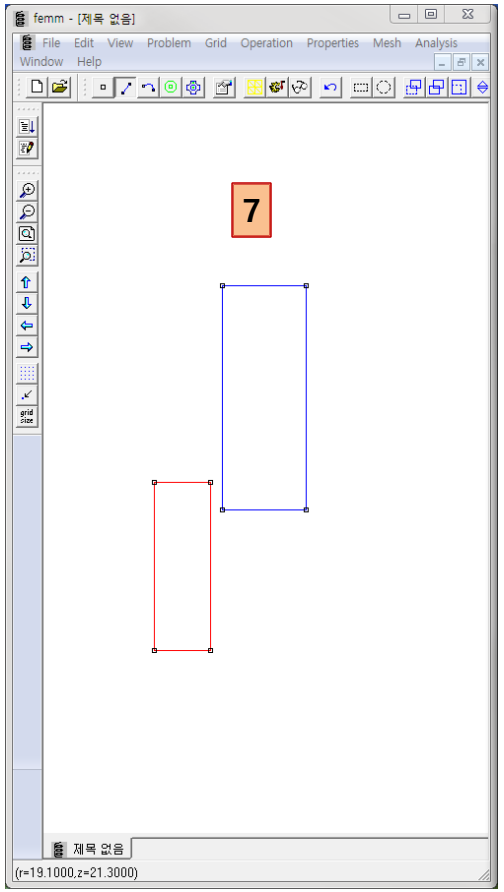
Add a plunger

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)







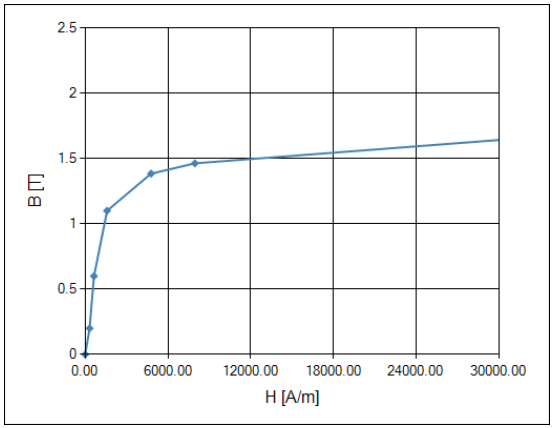


Open Actuator Project

Plunger Settings

8. Plunger setting
   - ✓ Part Material : 430 Stainless Steel
   - ✓ Moving Parts : **MOVING**

[BH curve]



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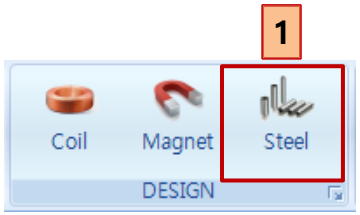
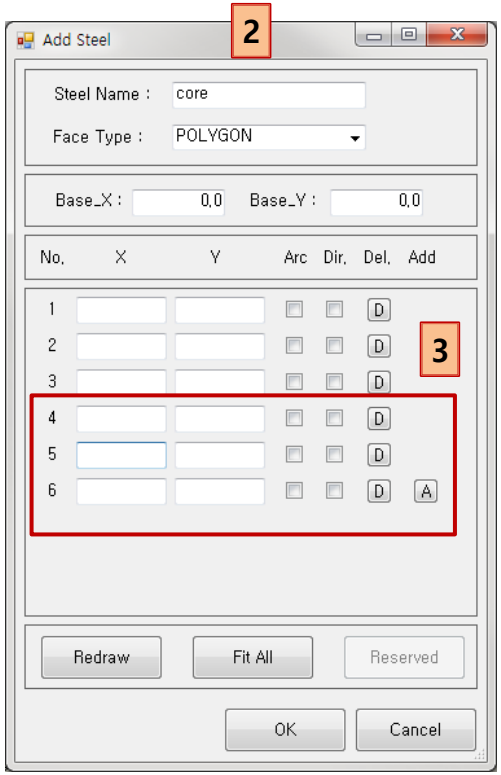
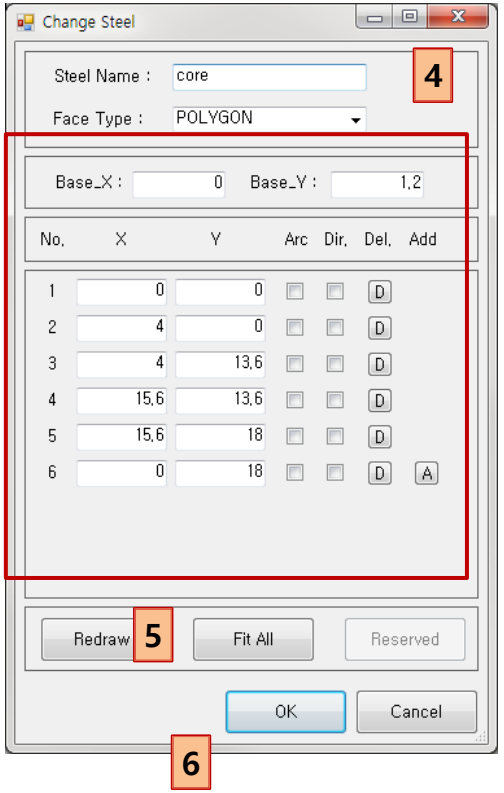
Common Fields	
Node Name	plunger
Specification Fields	
Part Material	430 Stainless Steel
Moving Parts	MOVING

Add a core

1. Toolbar > Click Steel Button
2. Steel Name : "core"
3. Add input lines of point
   - ✓ Click the 'A' button two times
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





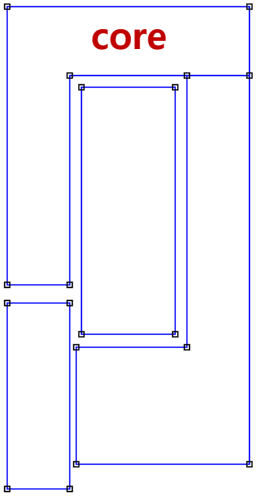


Core Settings

7. Check Shape (FEMM Window)

8. Core setting

   ✓ Part Material : 430 Stainless Steel



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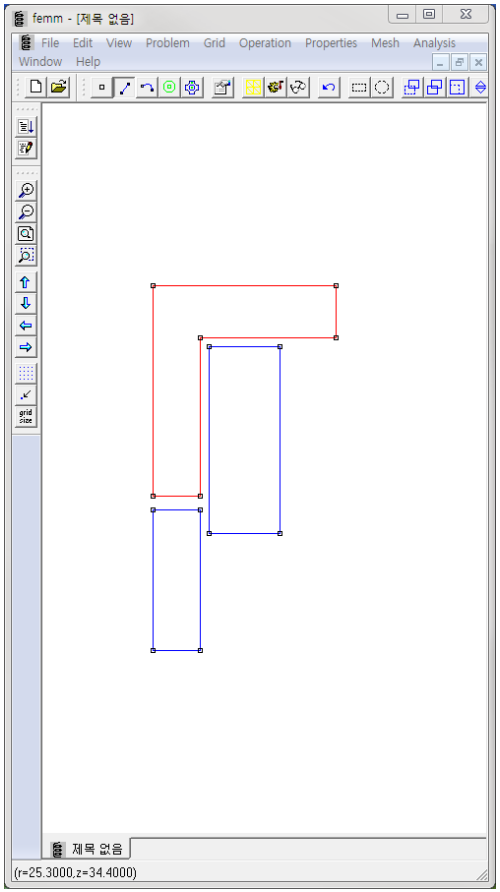
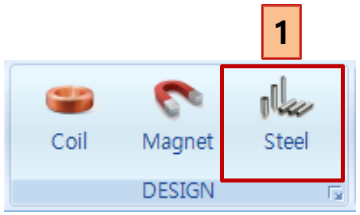
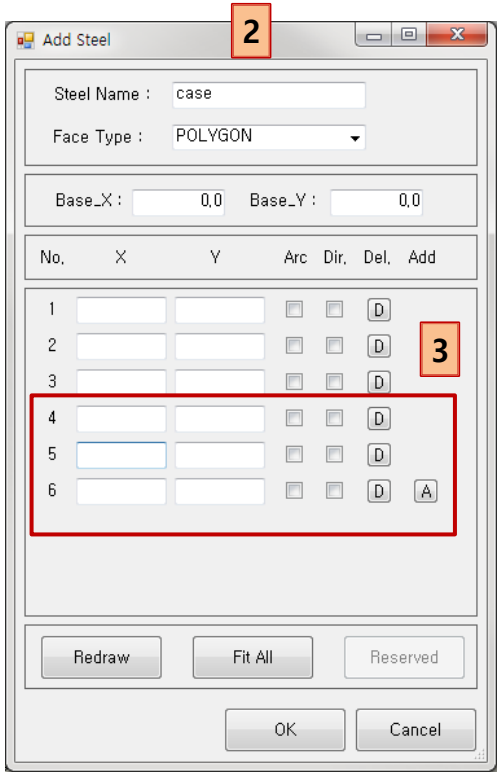


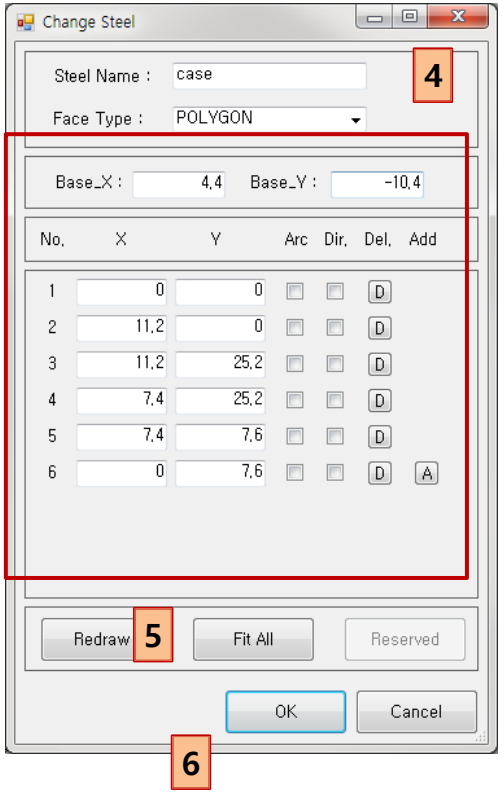
8

Add a case

1. Toolbar > Click Steel Button
2. Steel Name : "case"
3. Add input lines of point
   - ✓ Click the 'A' button two times
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





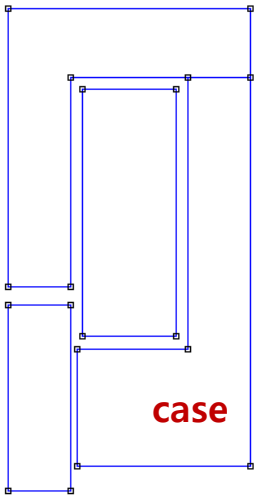


Case Setting

7. Check Shape (FEMM Window)

8. Case setting

   ✓ Part Material : 1010 Steel



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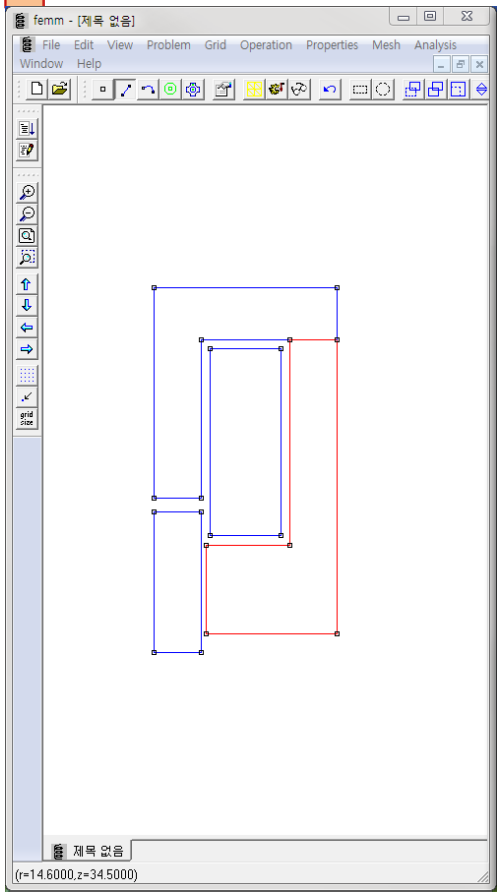

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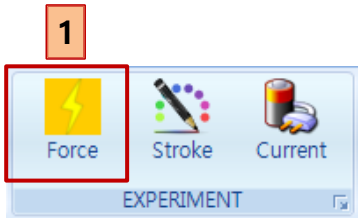
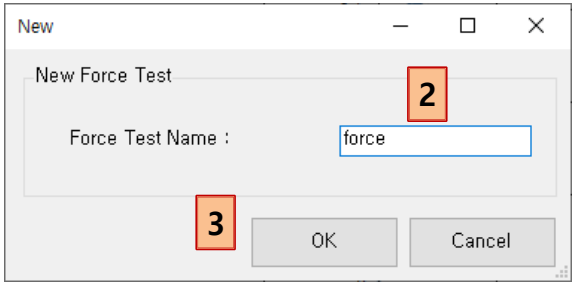
Common Fields	
Node Name	case
Specification Fields	
Part Material	1010 Steel
Moving Parts	FIXED

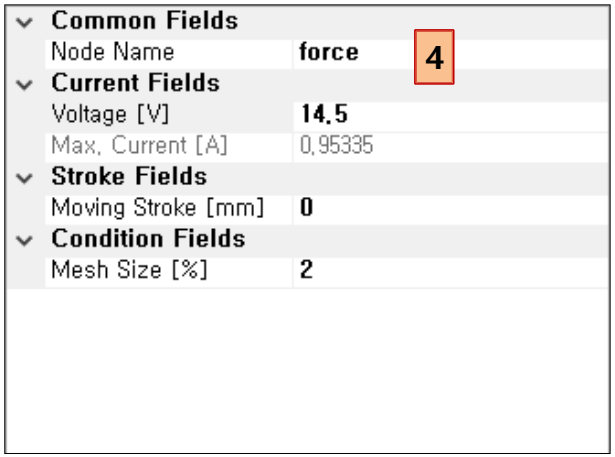
Virtual Test

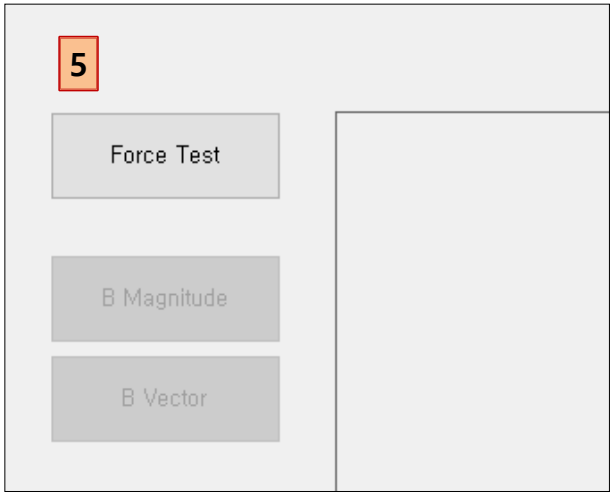
Test of the magnetic force

1. Toolbar > Click Force Button
2. Force Test Name : "force"
3. Click OK Button
4. Test Setting
   - ✓ Voltage : 14.5 V
5. Click "Force Test" Button



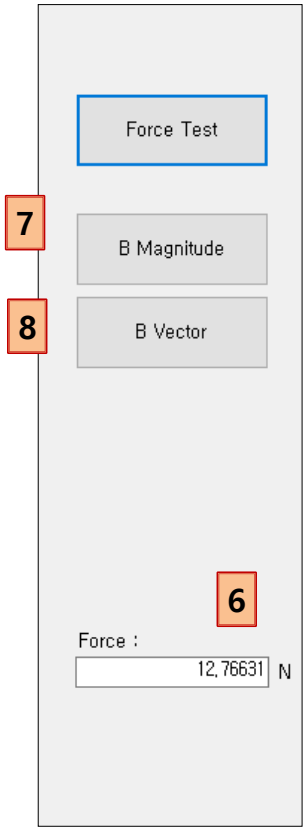


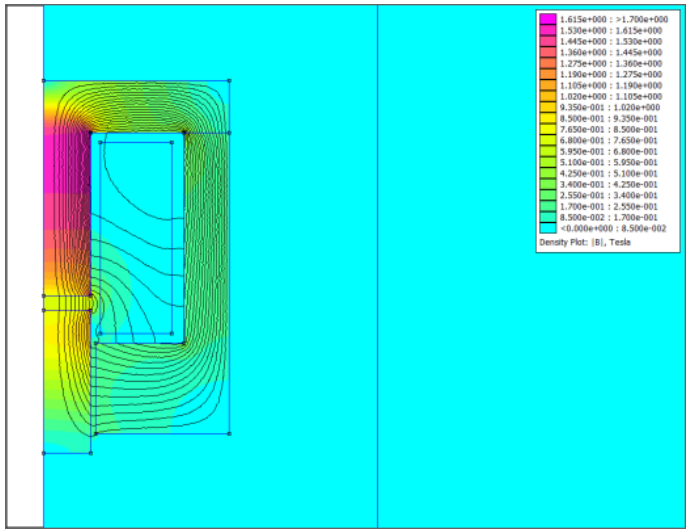


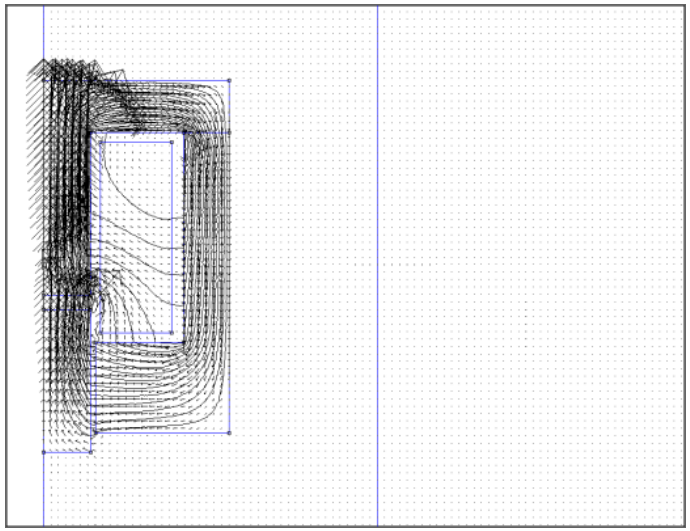


Results of the magnetic force

6. Force : 12.766 N
7. Magnetic Density
   - ✓ Click the B Magnitude button
8. Vector of Magnetic Density
   - ✓ Click the B Vector button

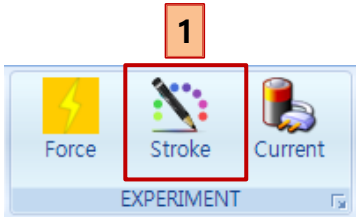


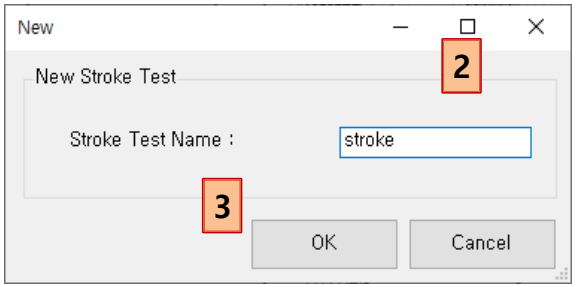


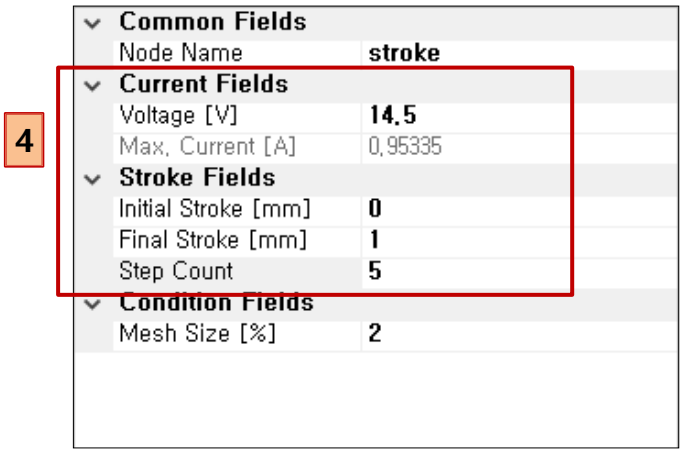


Test of the stroke-magnetic force

1. Toolbar > Click Stroke Button
2. Stroke Test Name : "stroke"
3. Click OK Button
4. Test Settings
   - ✓ Voltage : 14.5
   - ✓ Initial Stroke : 0.0
   - ✓ Final Stroke : 1.0
   - ✓ Step Count : 5

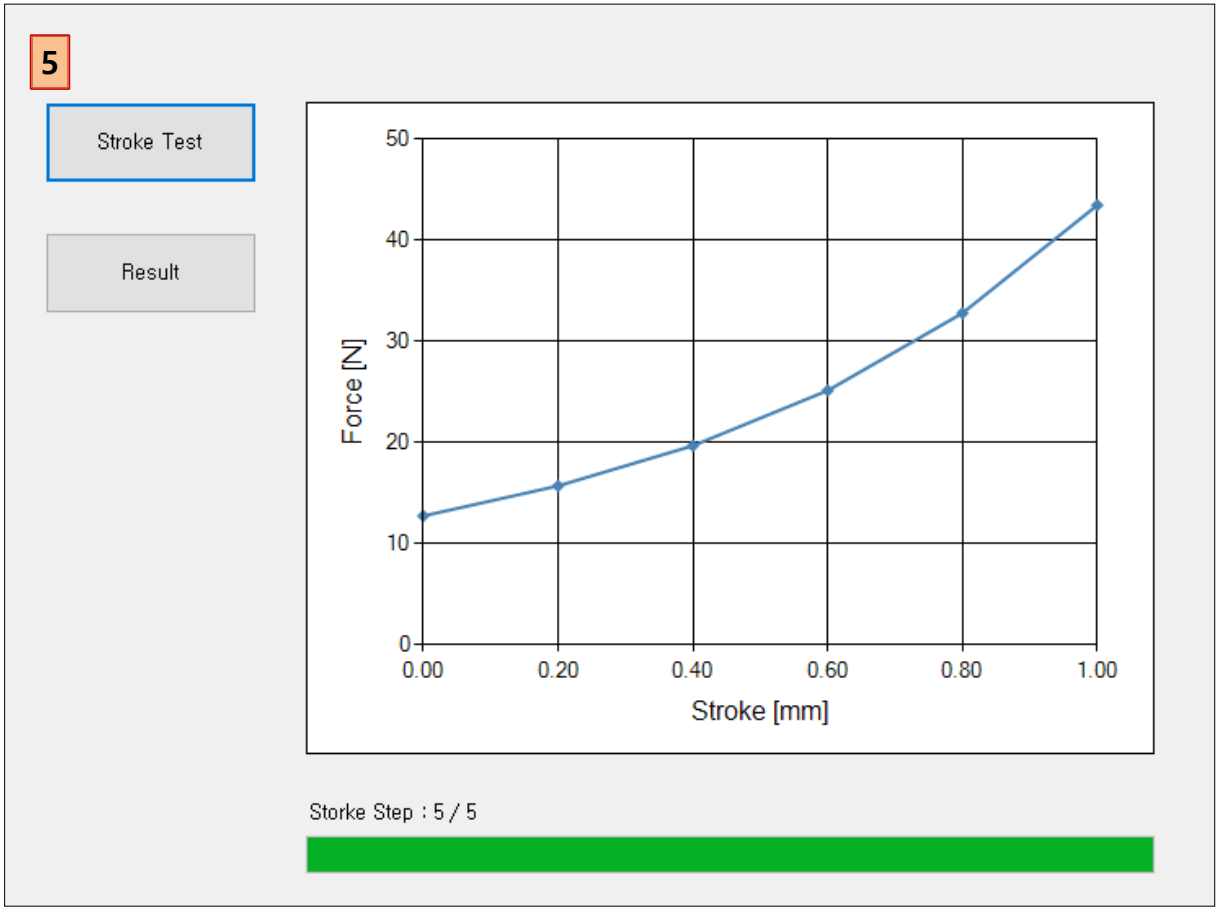






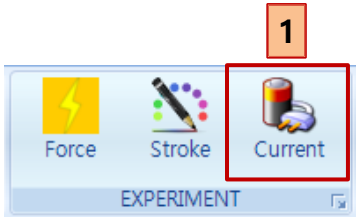
Results of the stroke-magnetic force

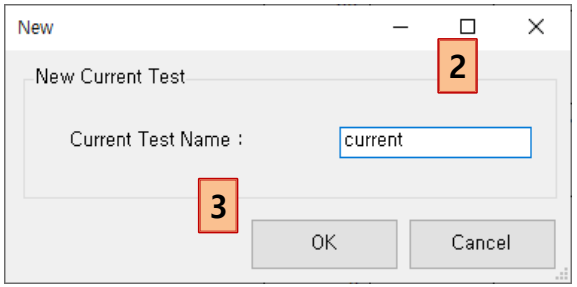
5. Click "Stroke Test" button

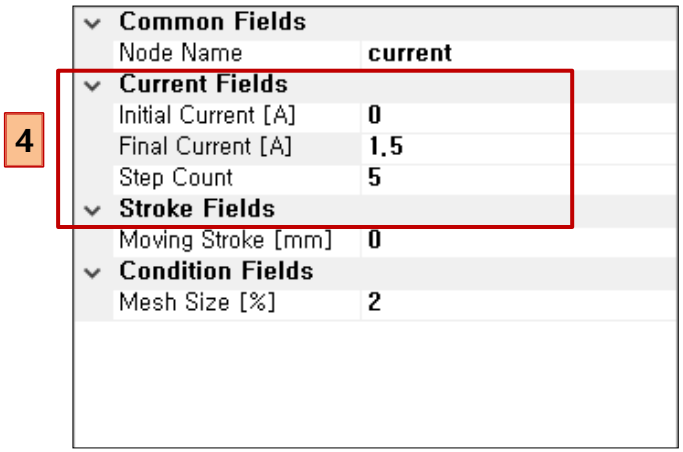


Test of the current-magnetic force

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

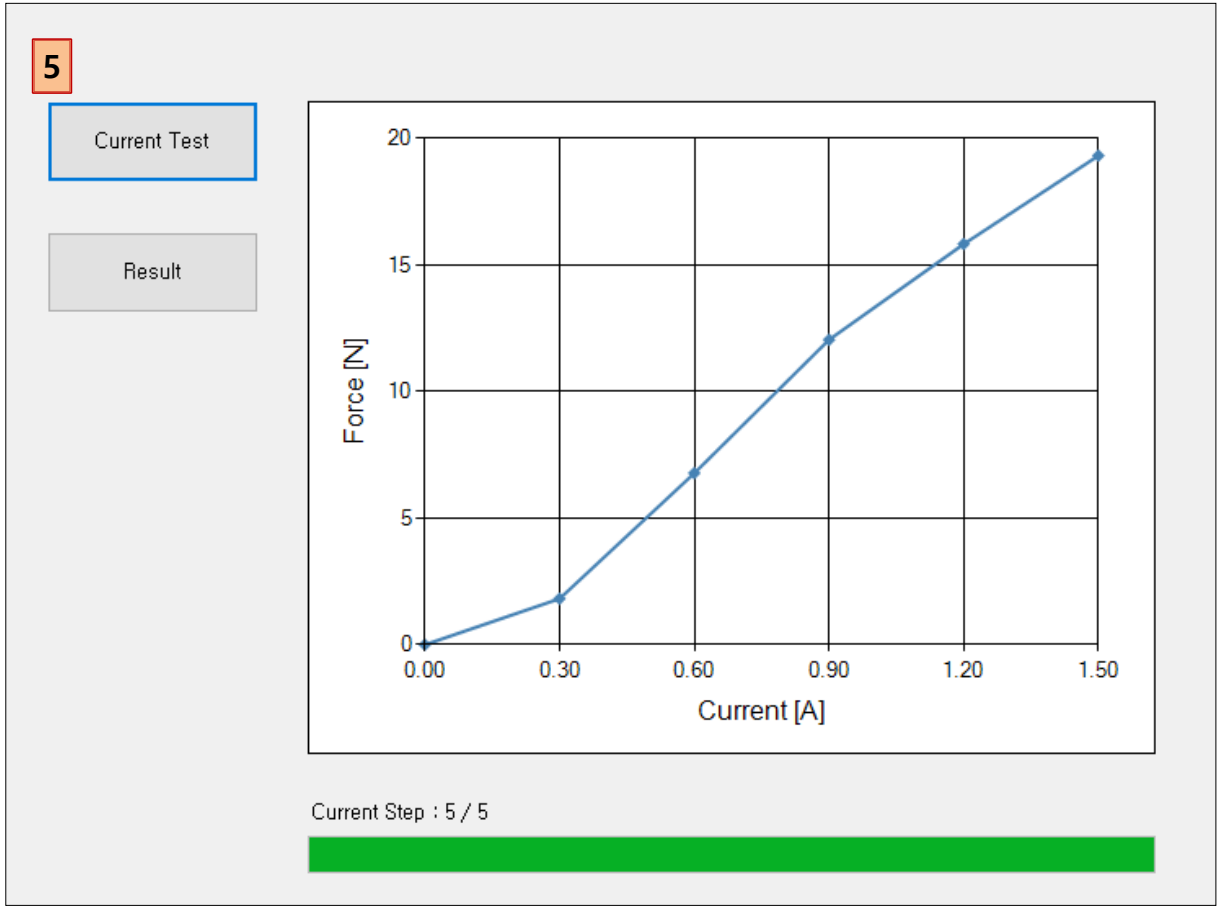






Results of the current-magnetic force

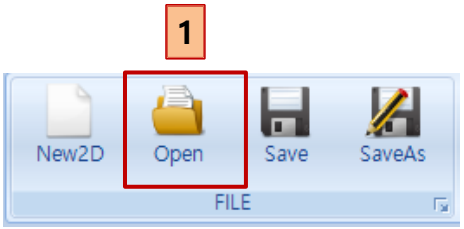
5. Click "Current Test" button

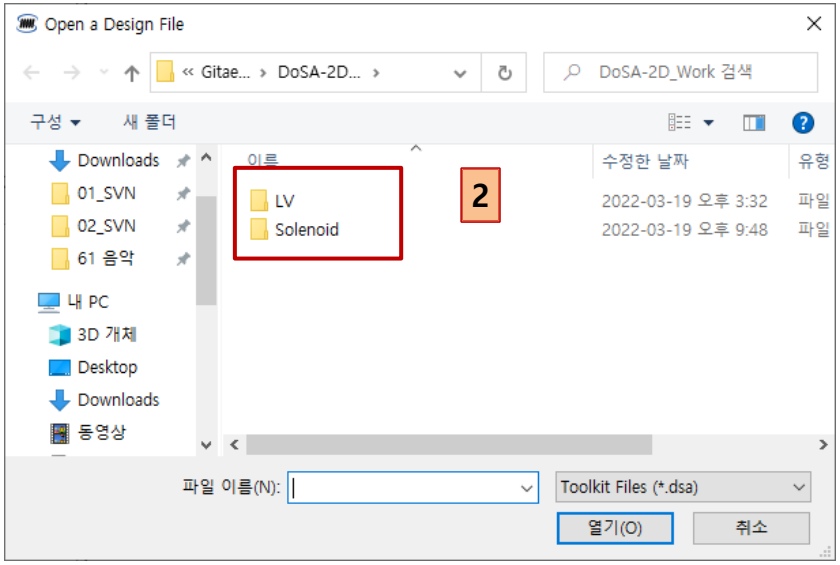


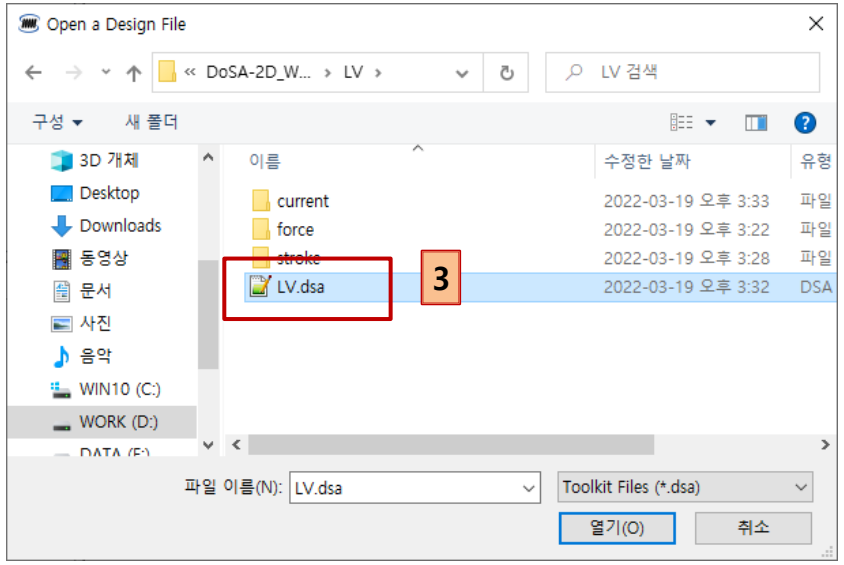
Tips

Open design

1. Toolbar > Click Open Button
2. Double click the design directory.
3. Double click the design file.







Thank You