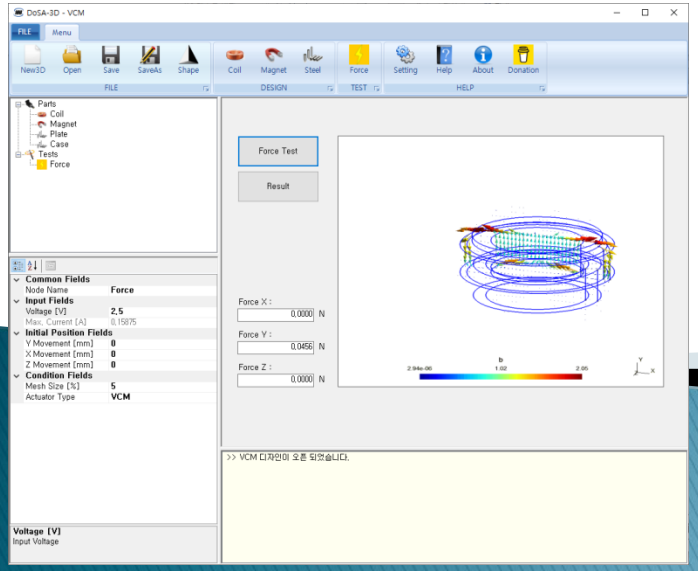
DoSA-3D User Manual

Voice Coil Motor Example

(Speaker, Auto-Focus, Linear Vibrator)



2022-05-07

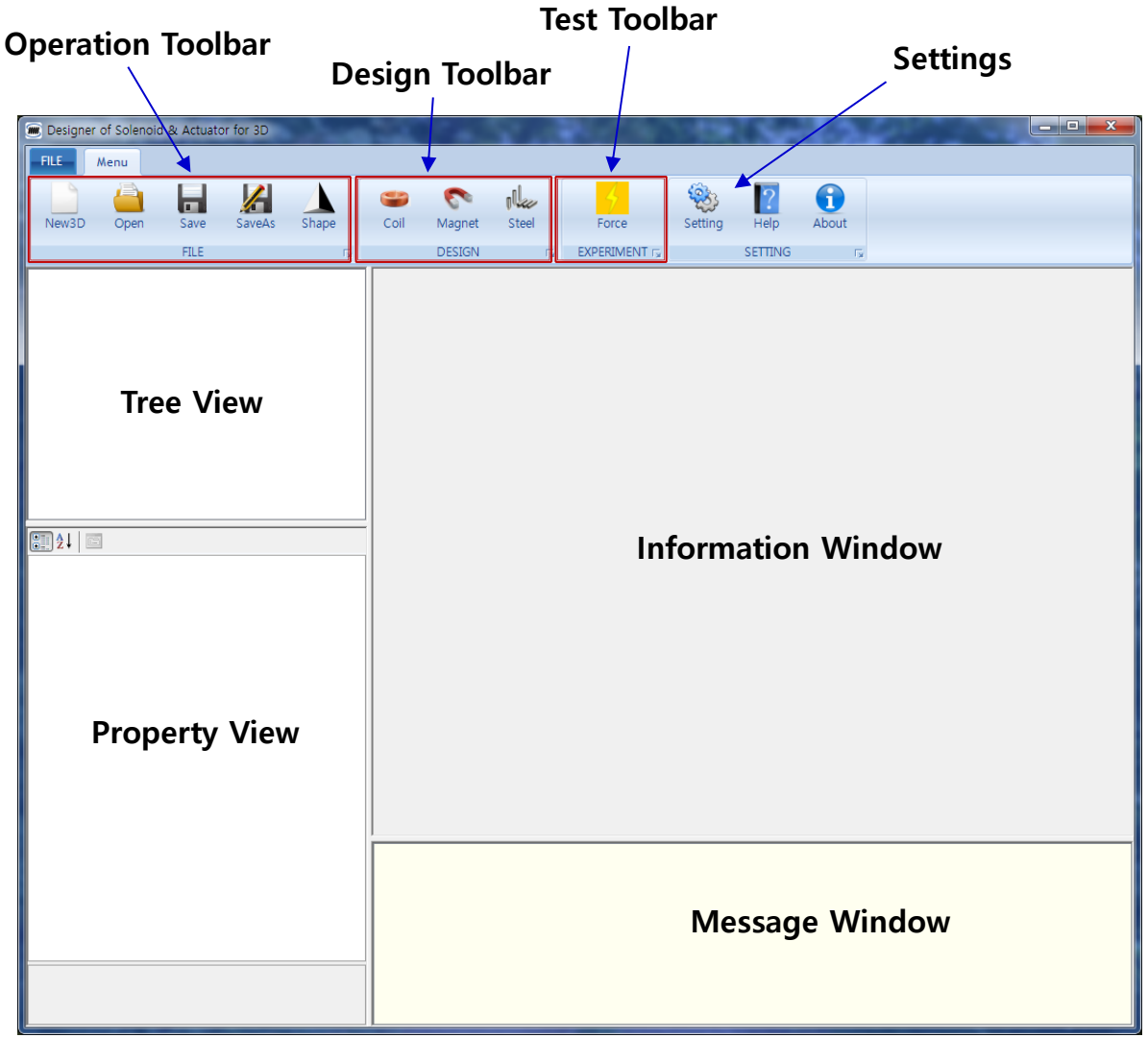
zgitae@gmail.com

DoSA Structure

PC Requirement

- CPU : 4 Core and above
- RAM : 16GB and above

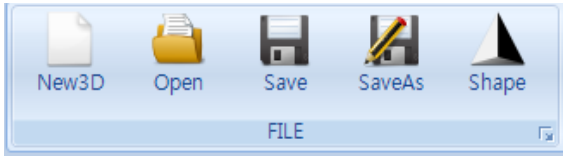
Program Structure



Toolbar

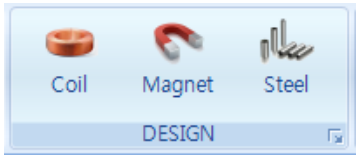
1. Operations

- ✓ New : Create a new design
- ✓ Open : Open previous design
- ✓ Save : Save the design
- ✓ SaveAs : Save in different name
- ✓ Shape : Check the 3D Shape



2. Design

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



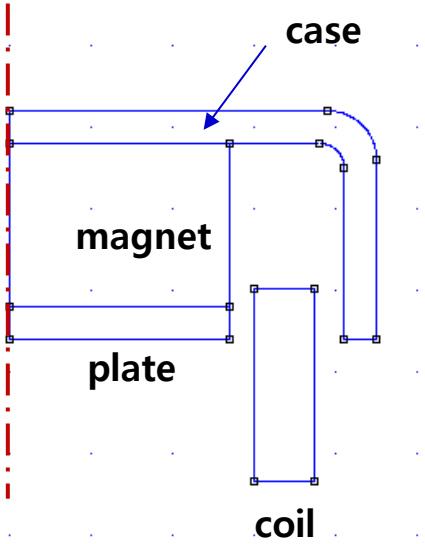
3. Virtual Test

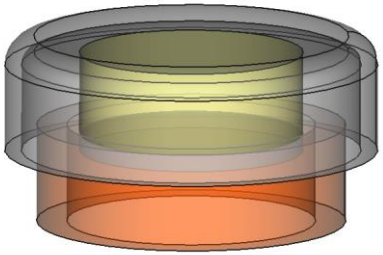
- ✓ Force : Magnetic force estimation

Analysis Model

Analysis Model

1. Shape Model





VCM.step

2. Product Specifications

A. Coil

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

B. Magnet

- Material : NdFeB 40
- Magnetization Direction : 90 (UP)

C. Power

- Voltage : 2.5V

(Example Files : DoSA-3D Install Directory > Samples > VCM)

New design

1. Toolbar > Click New button
2. Design Name : "VCM"
3. Shape File (STEP) : Select VCM.step (provided with this tutorial document)

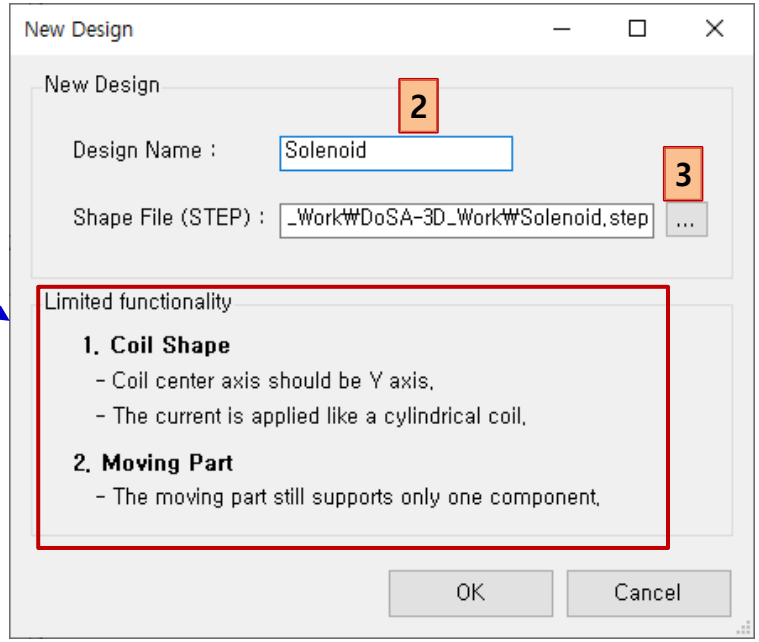
[Cautions for the Shape Model]

DoSA-3D still has the following functional limitations.

A. Limitation of Coil Shape
- Coil center axis should be Y axis direction.
- The current is applied like a cylindrical coil.
  (Square coils can cause some differences)

B. Moving Part
- The moving part still supports only one component.

C. Drawing Guide
- https://solenoid.or.kr/data/Drawing_Guide_ENG.pdf



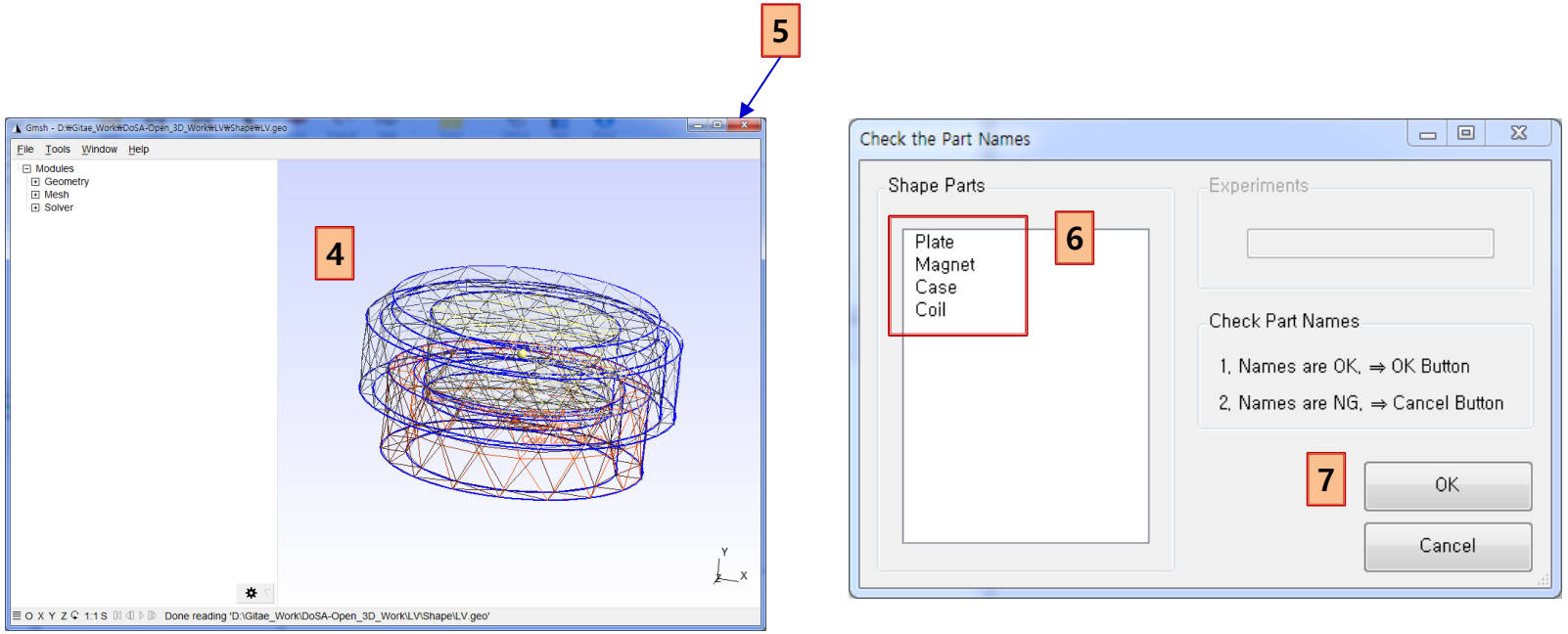
New design

4. Check the solenoid shape in Gmsh.

5. Exit the Gmsh.

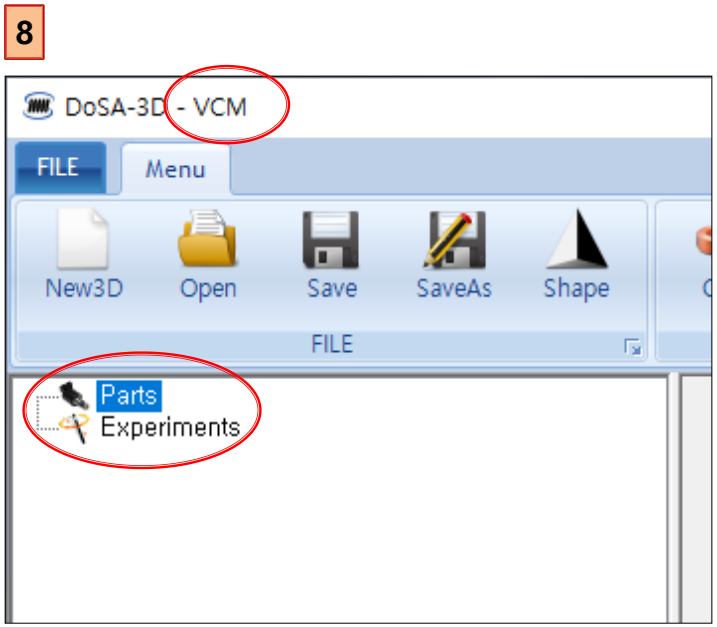
6. Check the part names.

7. Click the OK button if there are no problem with the shape and part names.



New design

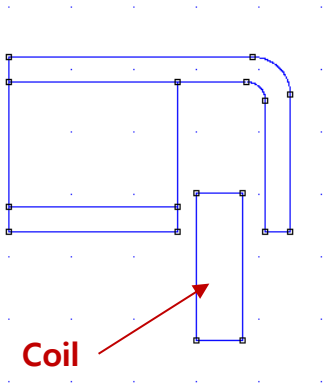
8. Check the design creation.

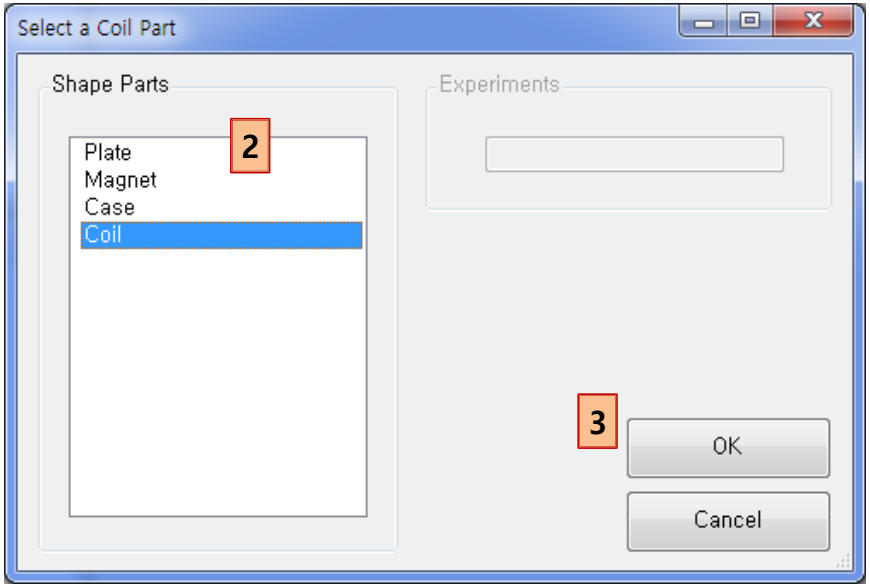


Parts Design

Add a coil

1. Toolbar > Click Coil button
2. Select "Coil" in the list box.
3. Click the OK button.





Coil design

Select the magnetic force calculation part

1. Input the coil instrumental specifications
   - ✓ Moving Parts : **MOVING**
   - ✓ Coil Wire Grade : Bonded_IEC_Grade_1B
   - ✓ Inner Diameter : 3
   - ✓ Outer Diameter : 3.73
   - ✓ Coil Height : 1.18
   - ✓ Copper Diameter : 0.045
   - ✓ Horizontal Coefficient : 0.95 (Bonded Type)
   - ✓ Vertical Coefficient : 1.13 (Bonded Type)
   - ✓ Resistance Coefficient : 1.1 (Bonded Type)

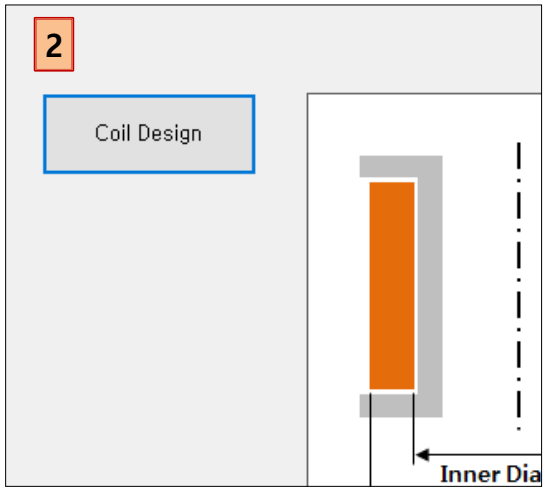
Common Fields	
Node Name	**Coil**
Specification Fields	
Part Material	**Copper**
Curent Direction	**IN**
Moving Parts	**MOVING**
Calculated Fields	
Coil Turns	**126**
Coil Resistance [Ω]	**15.74769**
Coil Layers	6
Turns of One Layer	21
Design Fields (optional)	
Coil Wire Grade	**Bonded_IEC_Grade_1B**
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 [℃]	**20**
Horizontal Coefficient	**0.95**
Vertical Coefficient	**1.13**
Resistance Coefficient	**1.1**

1

3

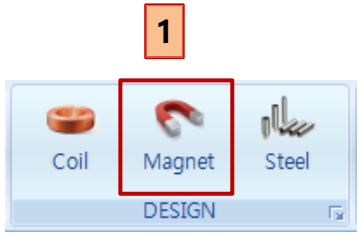
2. Calculate the coil specification
   - ✓ Click the "Coil Design" button

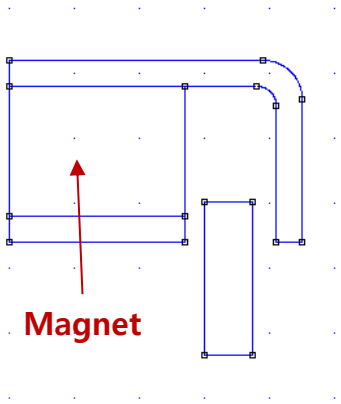
3. Check the coil specification

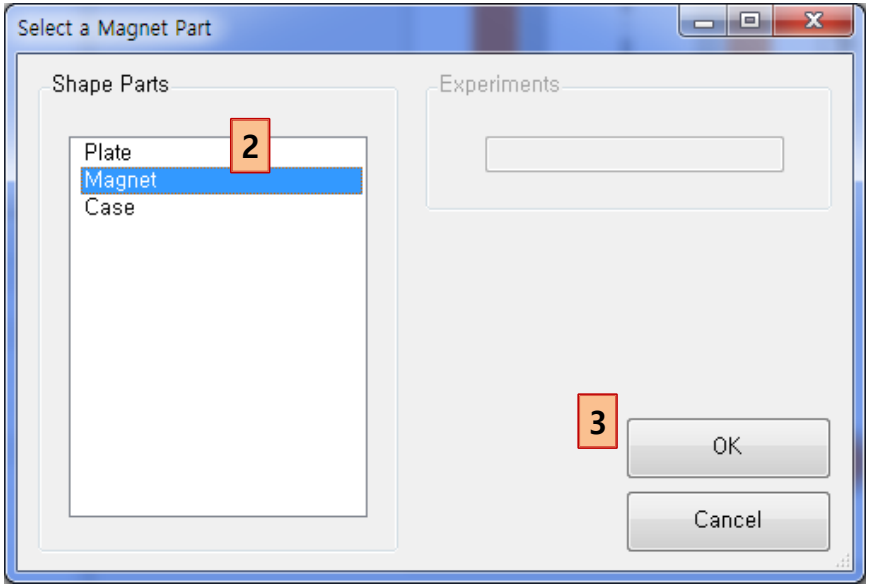


Add a magnet

1. Toolbar > Click Magnet button
2. Select "Magnet" in the list box.
3. Click the OK button.





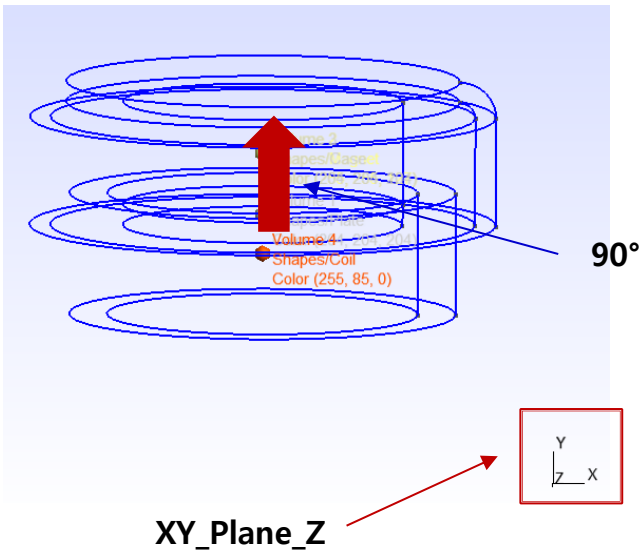


Magnet setting

1. Magnet Settings
   - ✓ Use default values

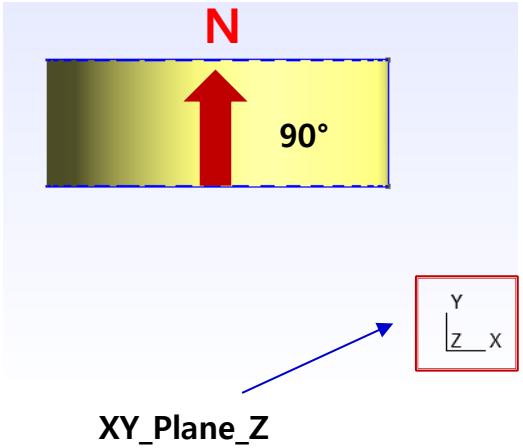
1

Common Fields	
Node Name	**Magnet**
Specification Fields	
Part Material	**NdFeB_40**
Hc	**969969**
Br	**1.26497**
Moving Parts	**FIXED**
Magnetization Fields	
Magnet Plane	**XY_Plane_Z**
Magnet Angle	**90**

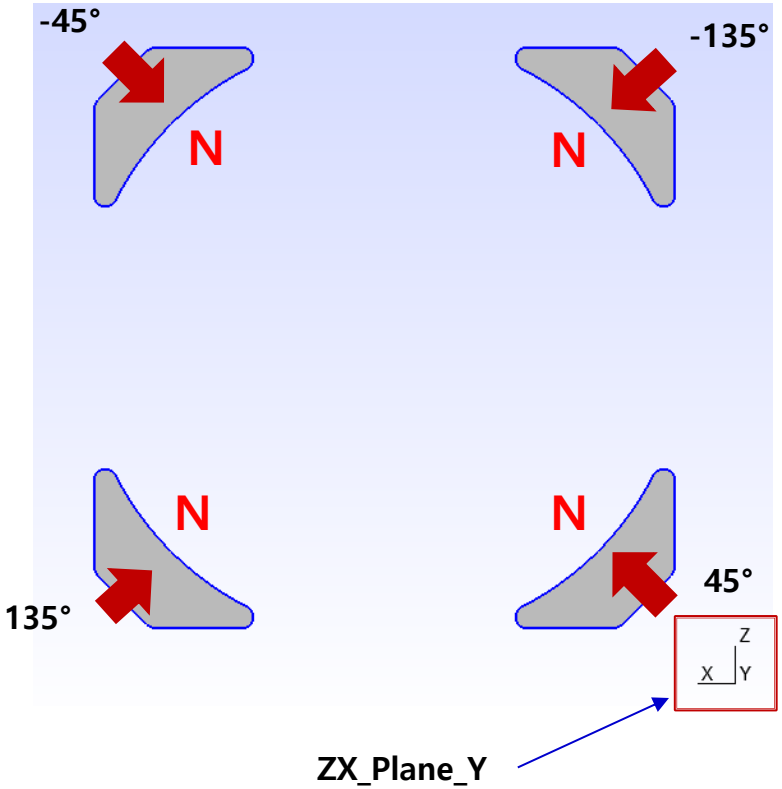


[Ref.] Magnetization Setting of Magnet

- ✓ Magnet Plane : XY_Plane_Z
- ✓ Magnet Angle : 90

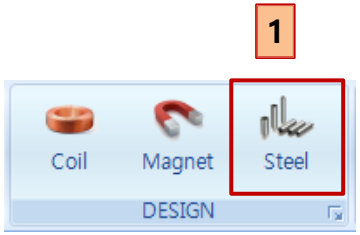


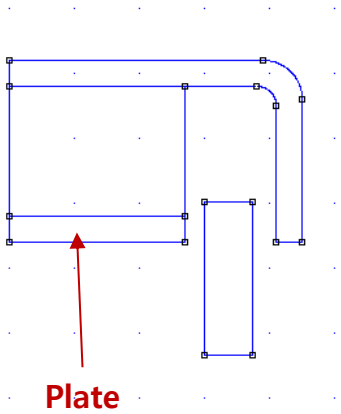
- ✓ Magnet Plane : ZX_Plane_Y
- ✓ Magnet Angle : 45° (135°, -45°, -135°)



Add a plate

1. Toolbar > Click Steel button
2. Select "Plate" in the list box.
3. Click the OK button.





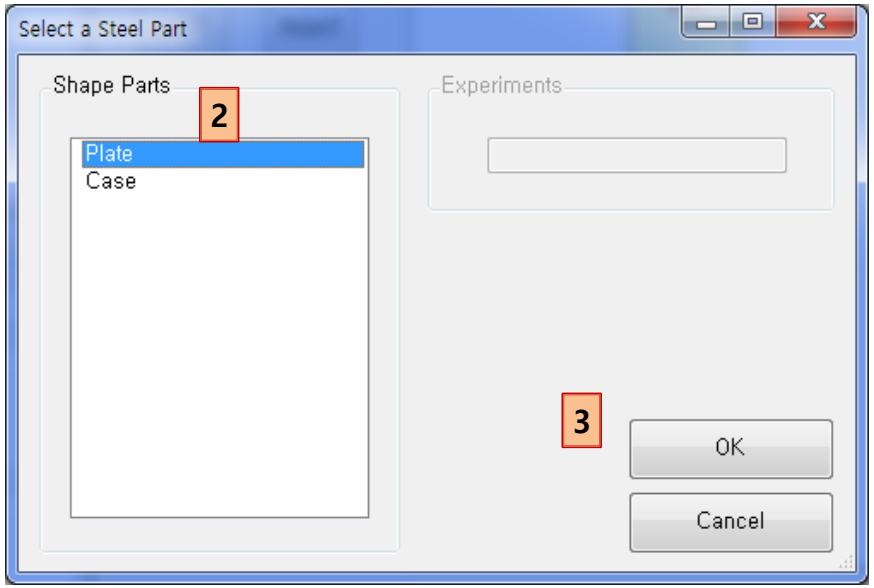
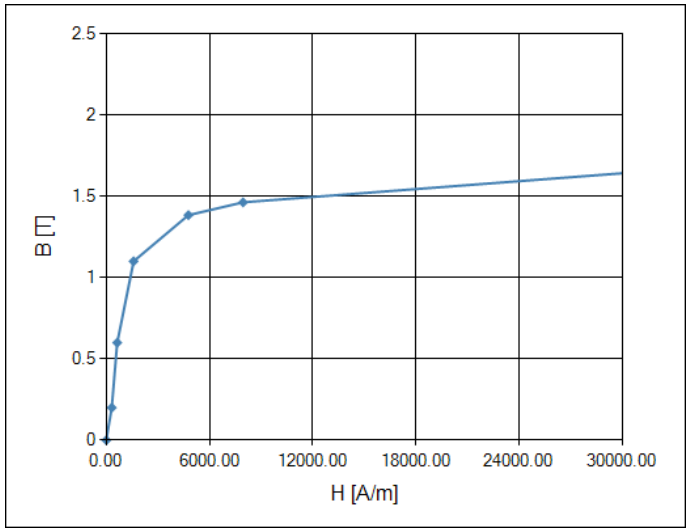


Plate setting

1. Plate settings

   ✓ Part Material : SUS_430

[BH Curve]

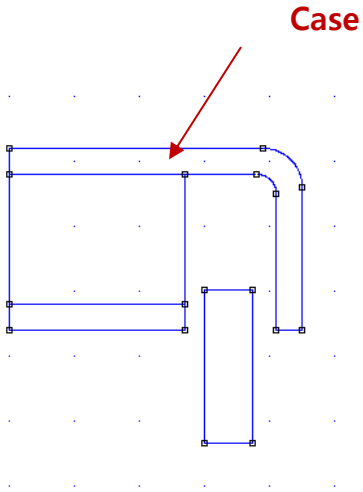


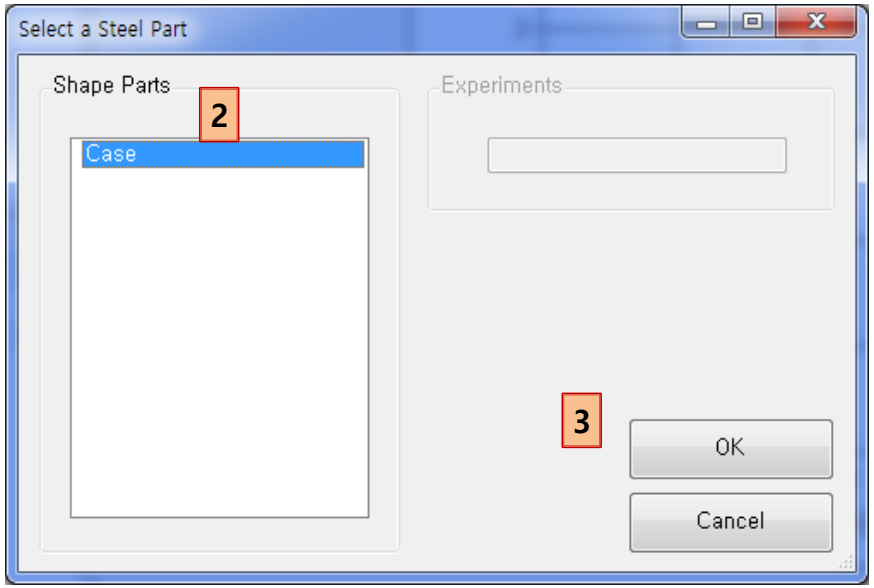
1

Common Fields	
Node Name	Plate
Specification Fields	
Part Material	SUS_430
Moving Parts	FIXED

Add a case

1. Toolbar > Click Steel button
2. Select "Case" in the list box.
3. Click the OK button.



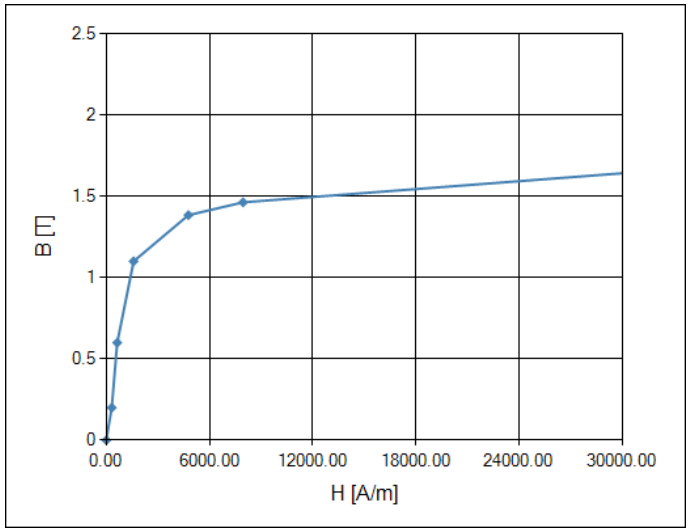


Case setting

1. Case Setting

   ✓ Part Material : SUS_430

[BH Curve]



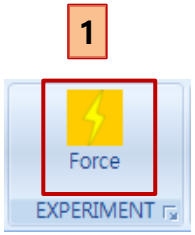
1

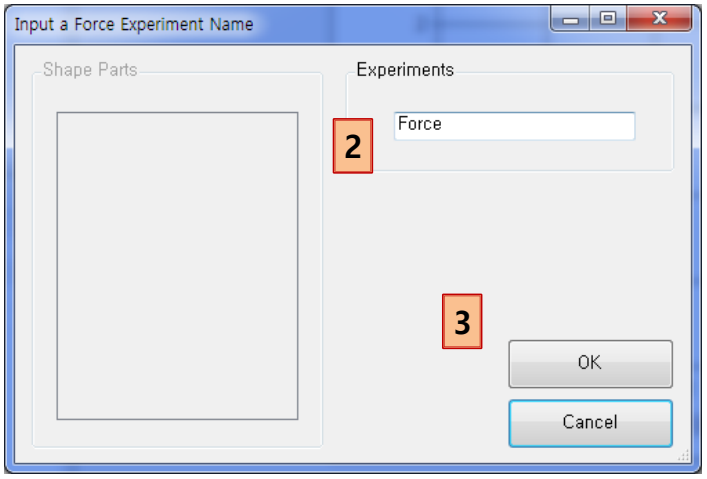
Common Fields	
Node Name	Case
Specification Fields	
Part Material	SUS_430
Moving Parts	FIXED

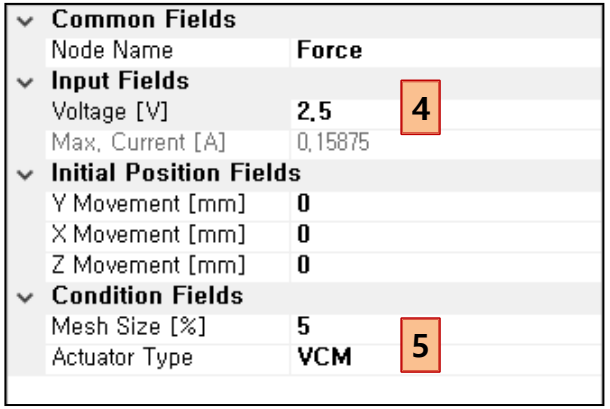
Virtual Test

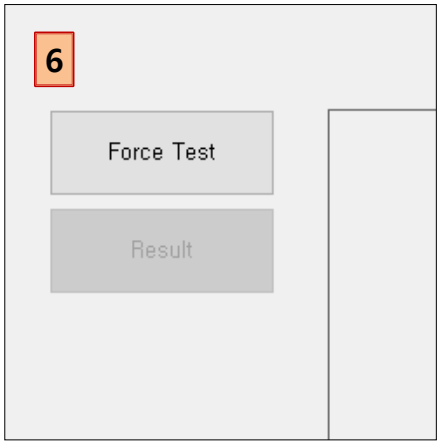
Test of the magnetic force

1. Toolbar > Click Force Button
2. Force Test Name : "Force"
3. Click OK button
4. Setting of magnetic force test
   - ✓ Voltage : 2.5
5. Setting of analysis condition
   - ✓ Mesh Size Percent : 5
   - ✓ Actuator Type : **VCM**
6. Click "Force Test" Button





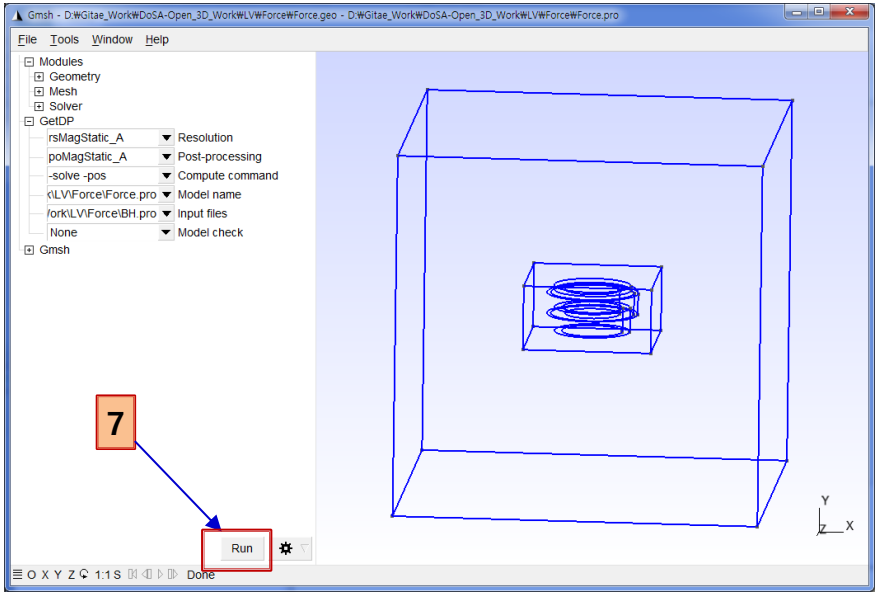


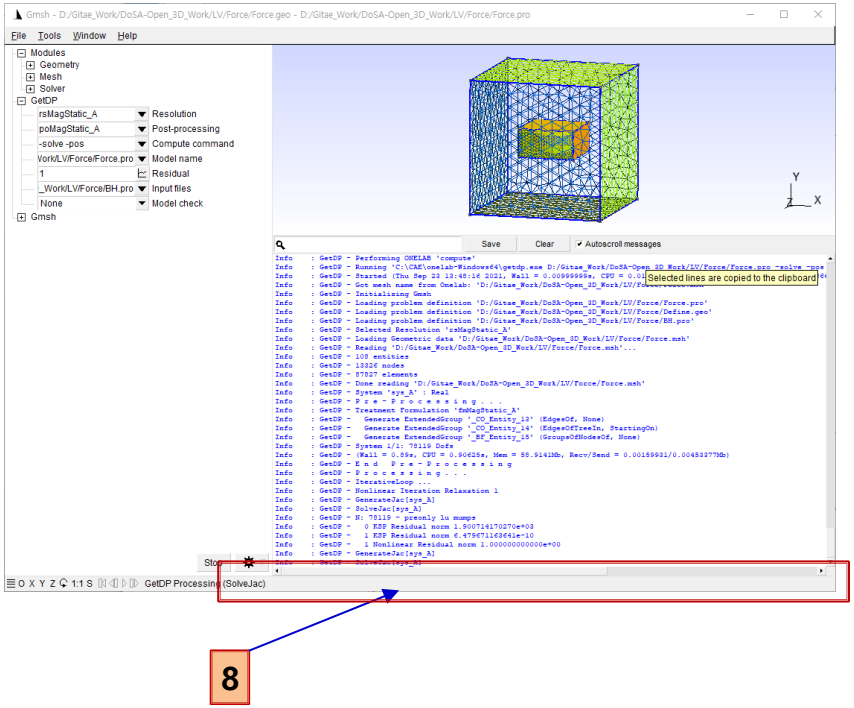


Run the virtual Test

7. Click the Run button after checking the shape.

8. If you want to see the analysis progress, click the status bar of the Gmsh.



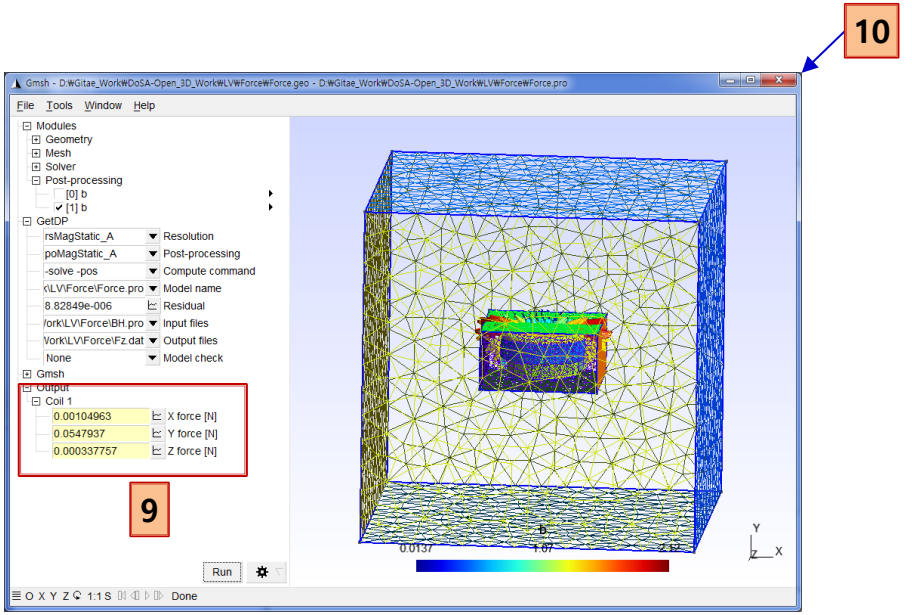


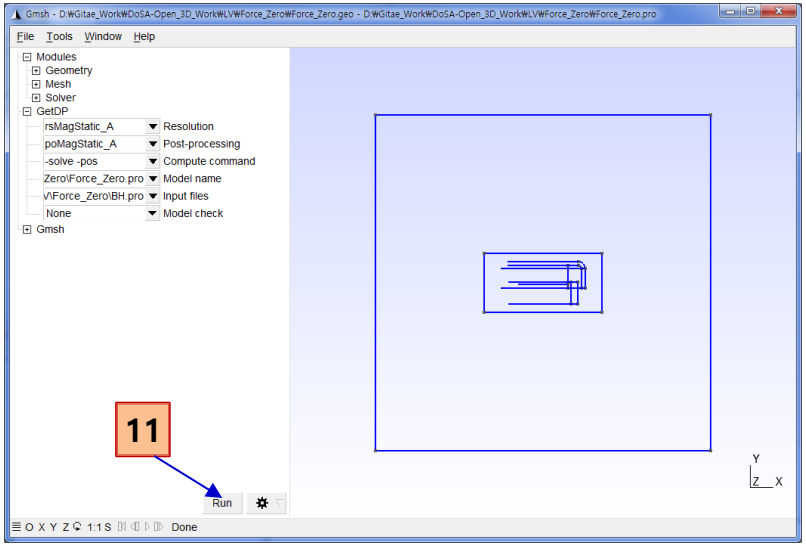
Run the virtual Test

9. Check the analysis results after solving. (The solving time is depend on you system specification)

10. **Quit the Gmsh.** (When finished, Gmsh is automatically restarted)

11. Click the run button again. (**VCM type actuators require twice analysis for accuracy**)

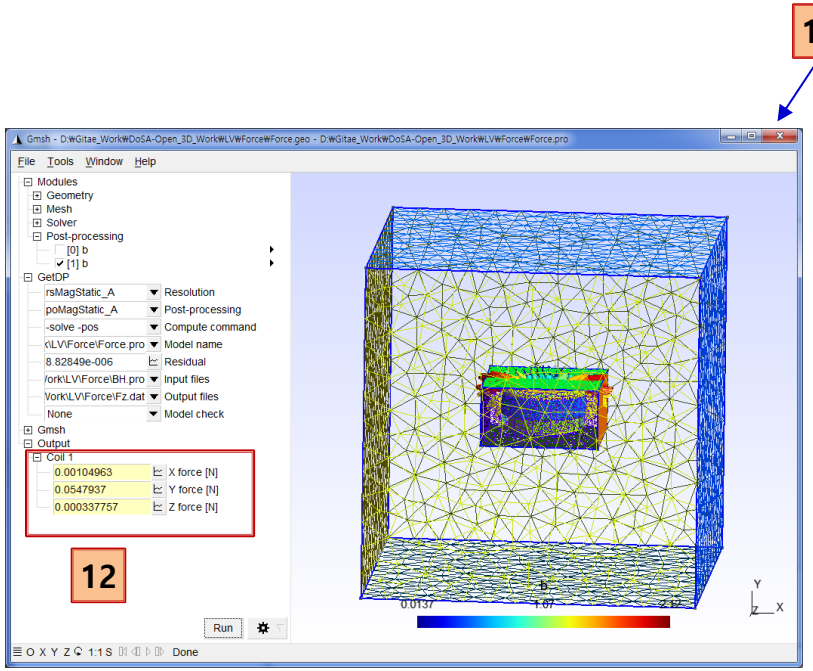


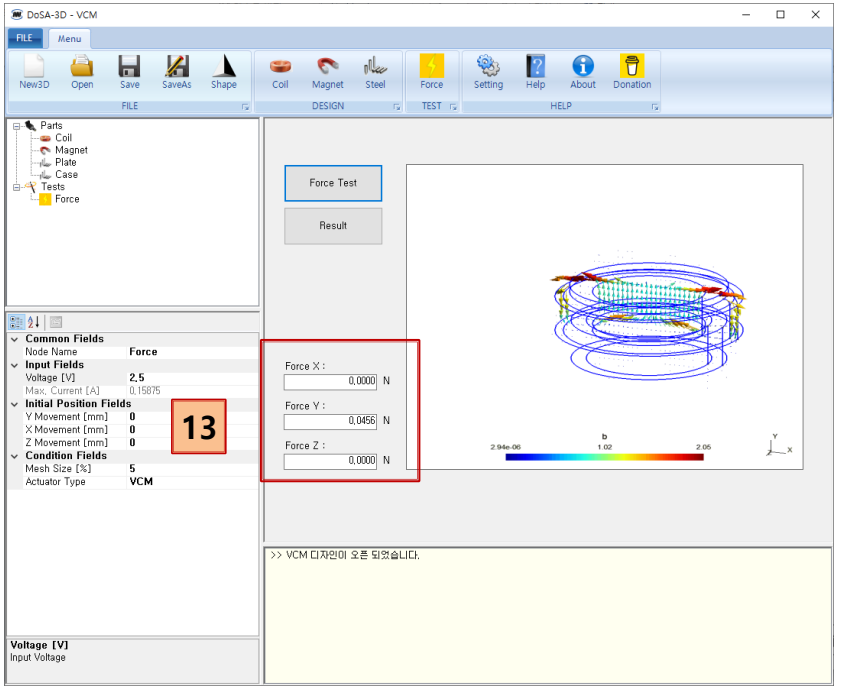


Results of the virtual Test

12. Quit the Gmsh after checking the analysis results.

13. Check the magnetic force of the VCM.

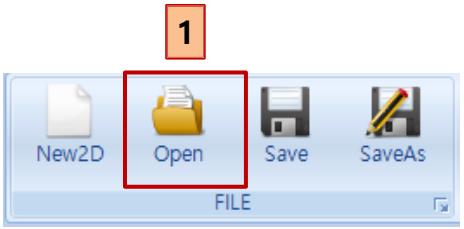


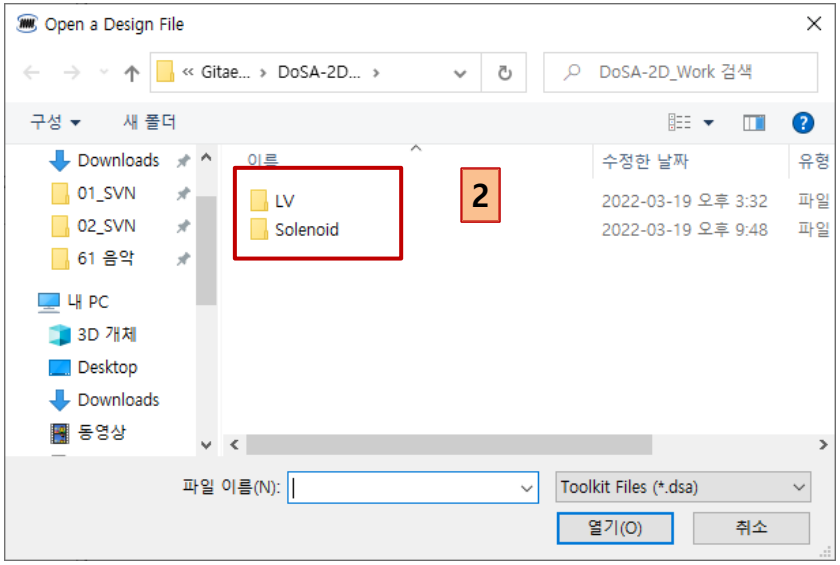


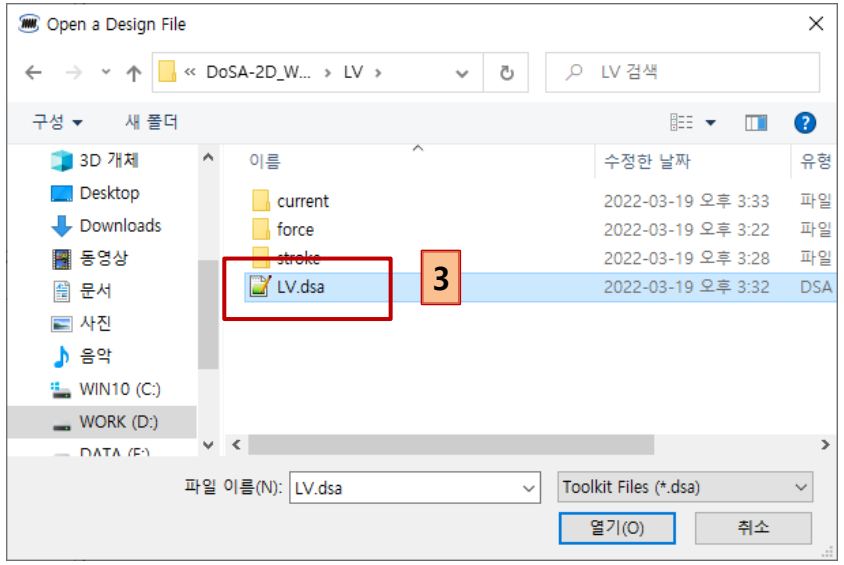
Tips

Open Design

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







Thank You

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Homepage : http://openactuator.org