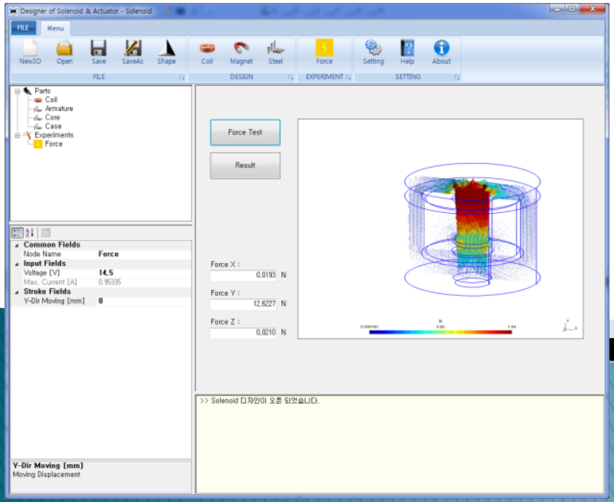
DoSA-Open_3D User Manual

Example of Linear Vibrator



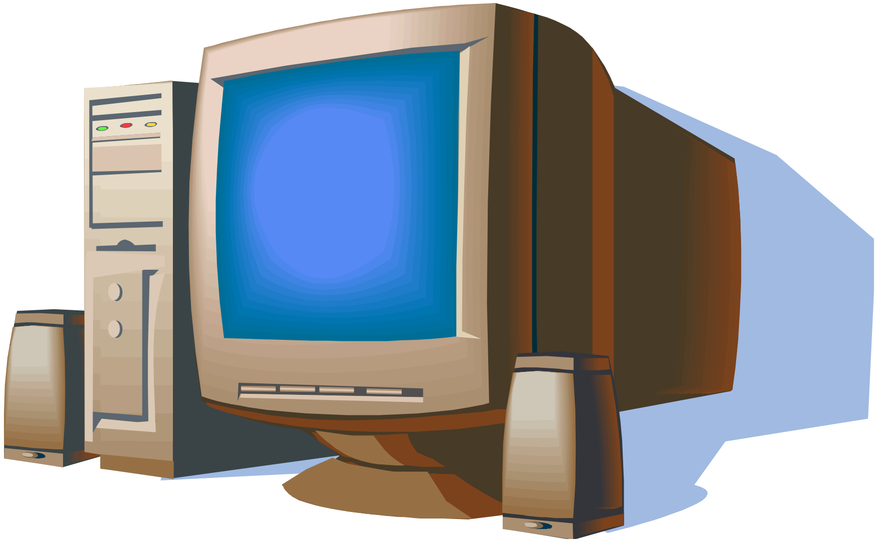
2020-12-02

GiTae Kweon (zgitae@gmail.com)

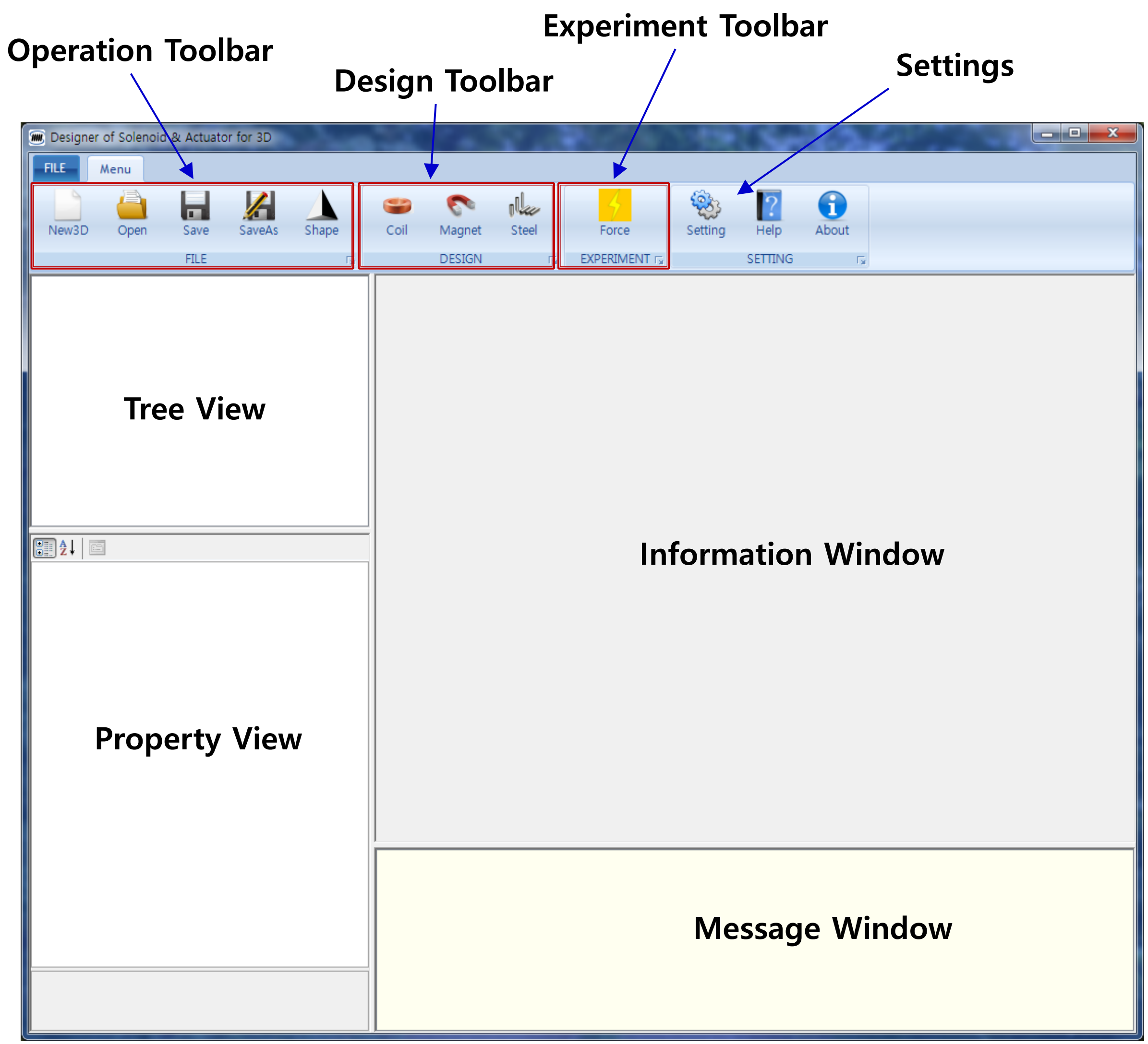
DoSA Structure

PC Requirement

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



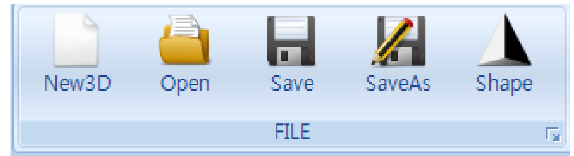
Program Structure



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

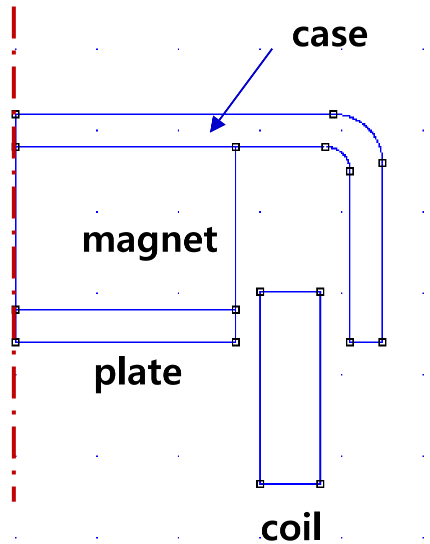
3. Experiment

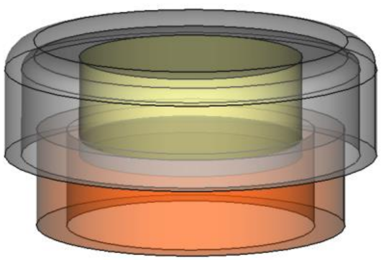
- ✓ Force : Magnetic force estimation for driving part

Analysis Model

Analysis Model

1. Shape Model





2. Product Specifications

A. Coil

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

B. Magnet

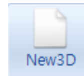
- Material : NdFeB 40
- Magnetization Direction : 90 (UP)

C. Power

- Voltage : 2.5V

(Example Files : DoSA-Open_3D Install directory > Samples > LV)

New design

1. Toolbar > Click New button 

2. Design Name : “LV”

3. Shape File (STEP) : Select LV.step (Example Files : DoSA Install directory > Samples > LV)

[Precautions for the Shape Model]

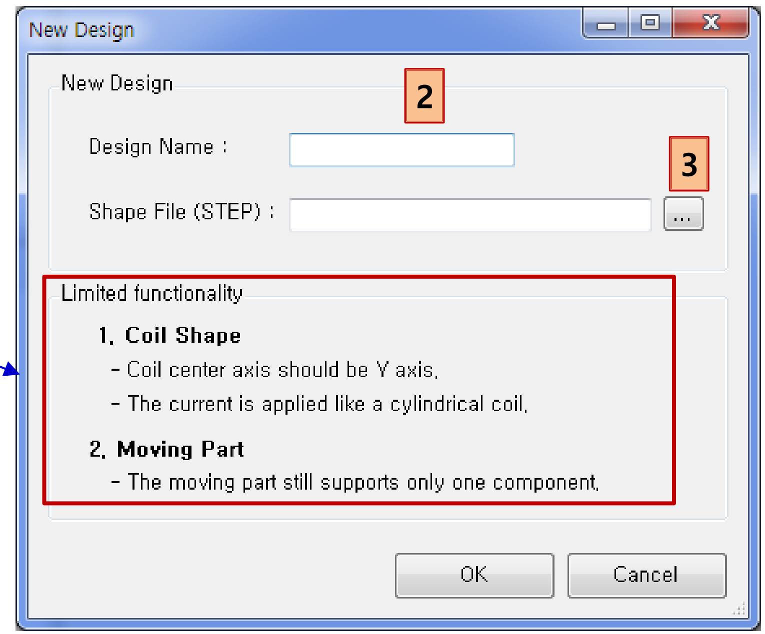
DoSA-Open_3D still has the following functional limitations.

가. 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)

나. Moving Part

- The moving part still supports only one component..



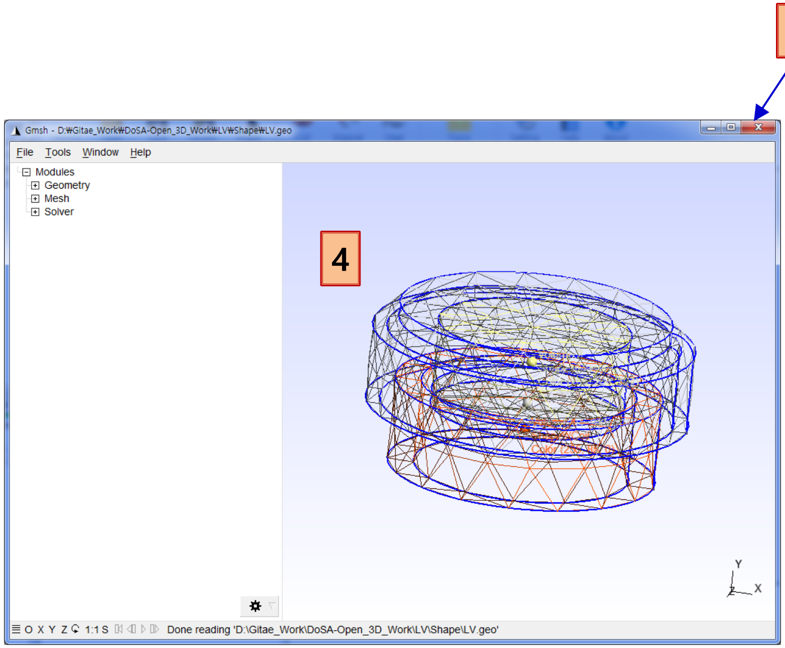
New design

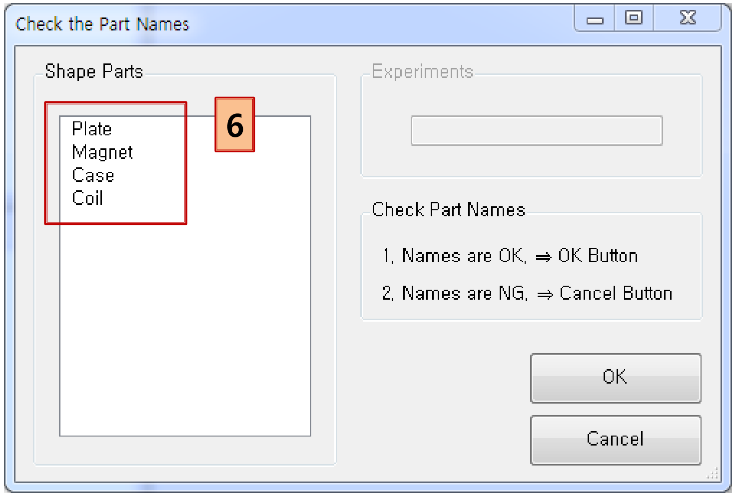
4. Check the solenoid shape in Gmsh.

5. Exit the Gmsh.

6. Check the part names.

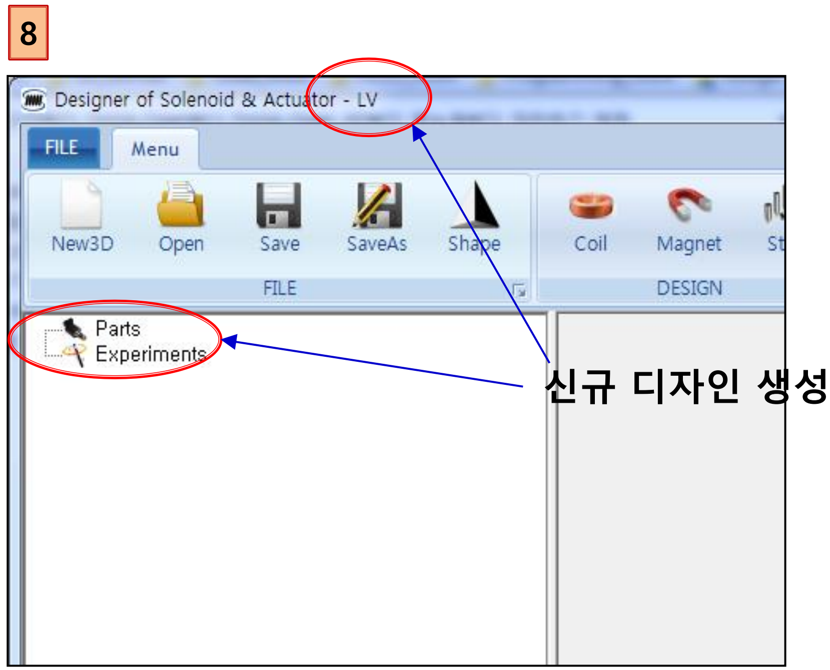
7. Click the OK button if there are no problem with the shape and part names.





New design

8. Check the design creation.

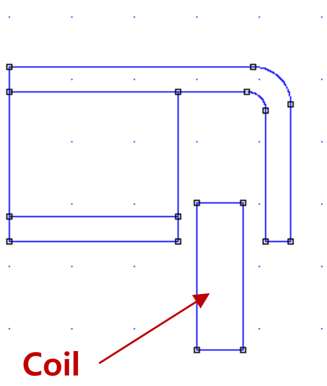


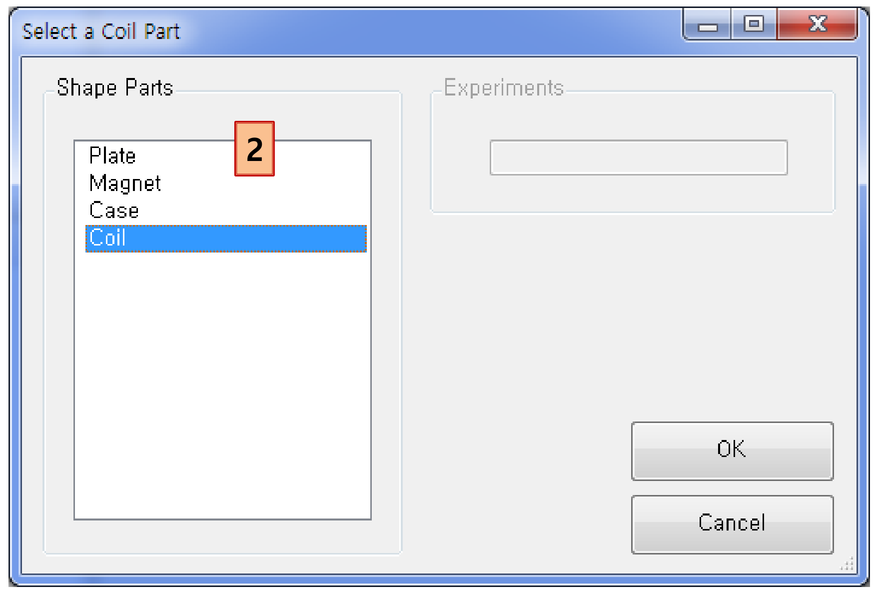
Parts Design

Add coil

1. Toolbar > Click Coil button

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





Coil design

1. Input the coil instrumental specifications

- ✓ Part Material : Select Copper
- ✓ Current Direction : Select IN (Inner direction)
- ✓ Moving Parts : MOVING (Moving Component)
- ✓ Coil Wire Grade : Bonded_IEC_Grade_1B
- ✓ Inner Diameter : 3 mm
- ✓ Outer Diameter : 3.73 mm
- ✓ Coil Height : 1.18 mm
- ✓ Copper Diameter : 0.045 mm
- ✓ Horizontal Coefficient : 0.95 (Bonded Type)
- ✓ Vertical Coefficient : 1.13 (Bonded Type)
- ✓ Resistance Coefficient : 1.1 (Bonded Type)

2. Calculate the coil specification

- ✓ Click the “Coil Design” button

1

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

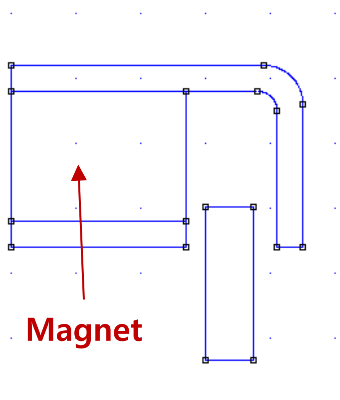
2

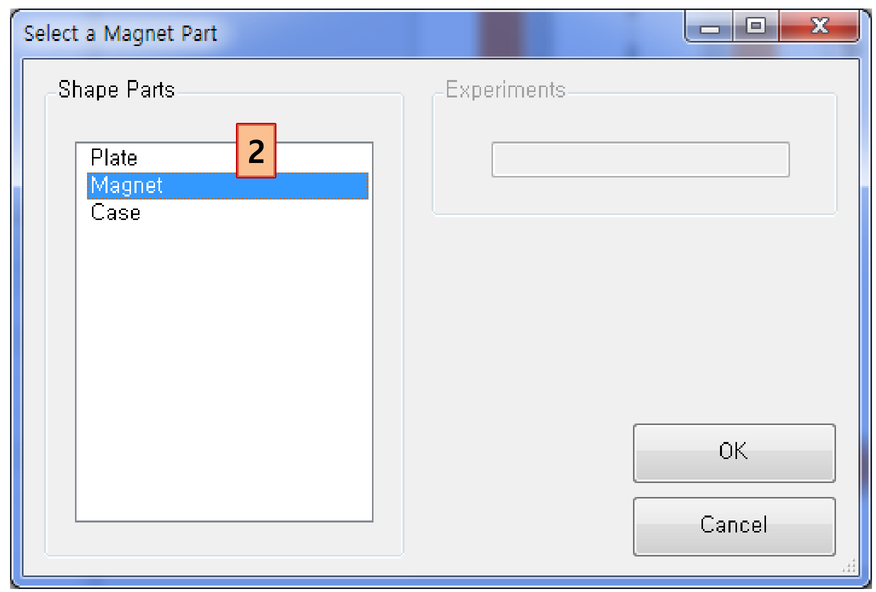
Coil Design

Add magnet

1. Toolbar > Click Magnet button

2. Select “Magnet” in the list box.
3. Click the OK button.





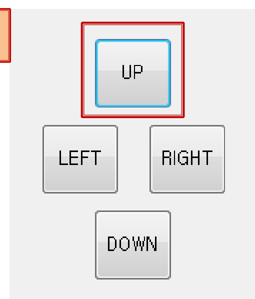
Magnet setting

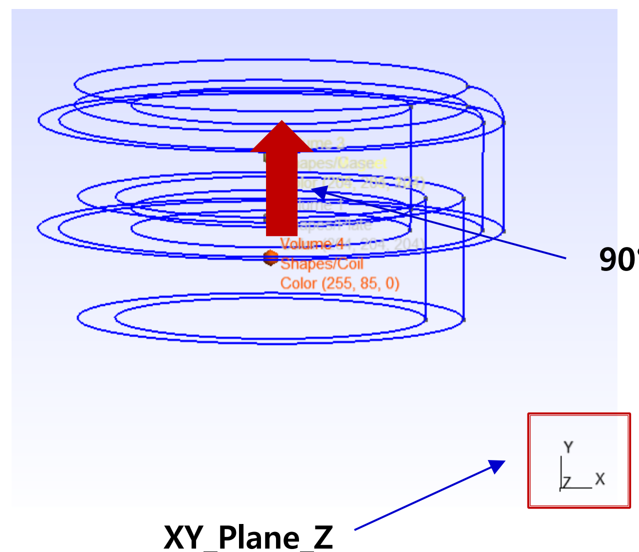
1. Magnet Settings
   - ✓ Part Material : NdFeB_40
   - ✓ Hc, Br is set automatically
   - ✓ Moving Parts : FIXED (Fixed Component)
   - ✓ Magnet Plane : XY_Plane_Z
   - ✓ Magnet Angle : 90 or Click the Up Button

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

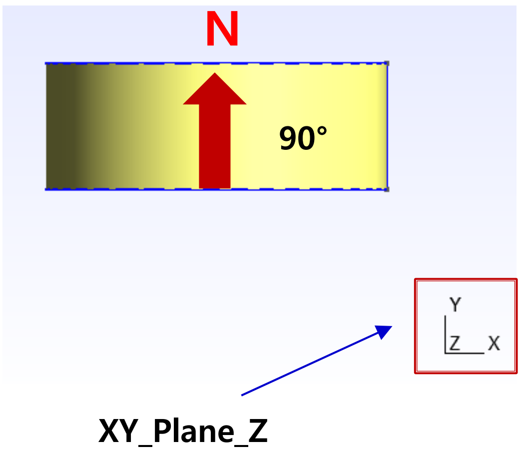
1



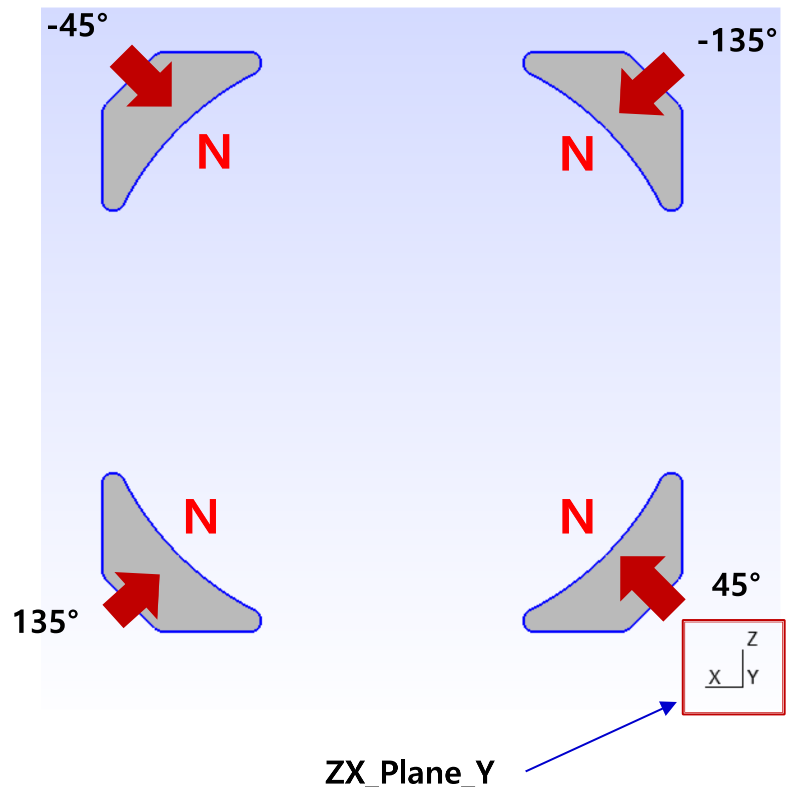


[Ref.] Magnetization Setting of Magnet

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



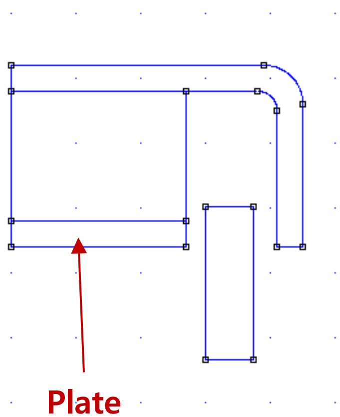
- ✓ Magnet Plane : ZX_Plane_Y
- ✓ Magnet Angle : 45° (135°, -45°, -135°)



Add plate

1. Toolbar > Click Steel button 

2. Select “Plate” in the list box.
3. Click the OK button.



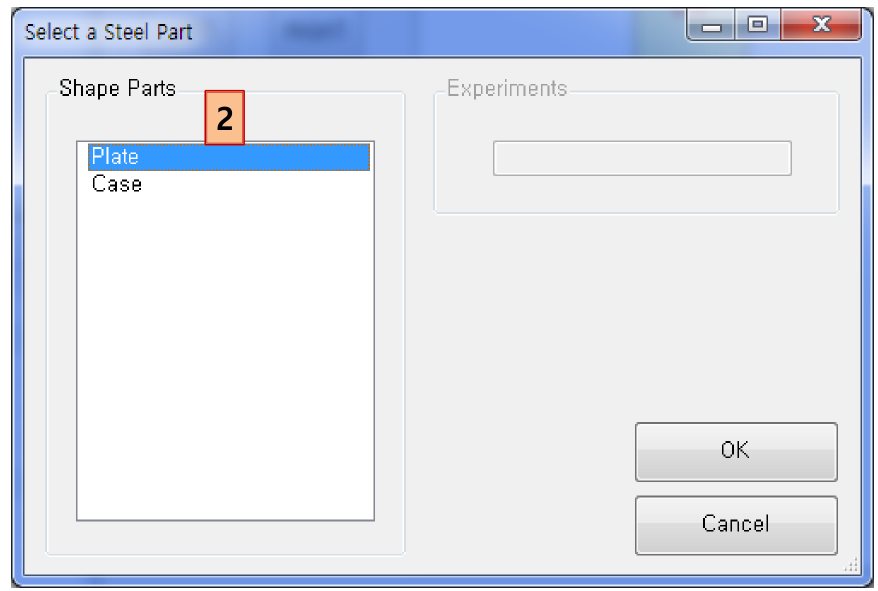


Plate setting

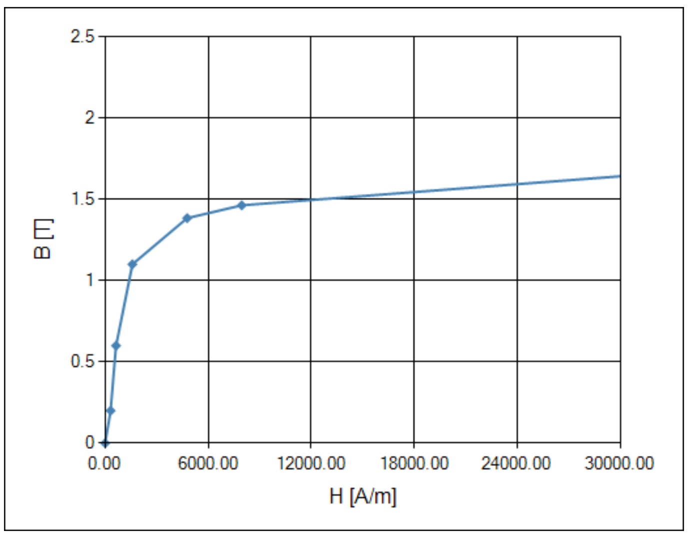
1. Plate settings

   - ✓ Part Material : SUS_430
   - ✓ Moving Parts : FIXED (Fixed Component)

1

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

[BH Curve]

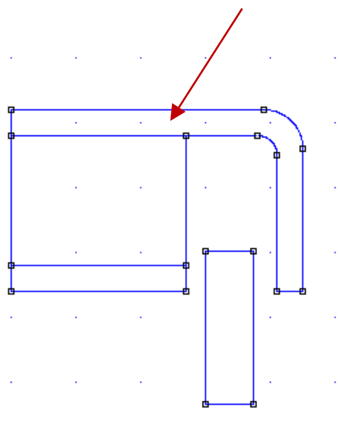


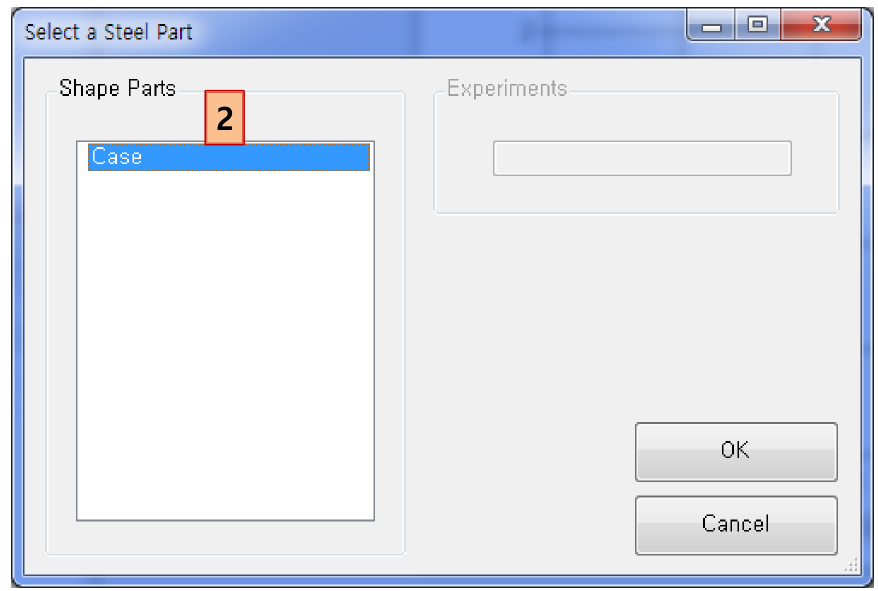
Add case

1. Toolbar > Click Steel button 

2. Select “Case” in the list box.
3. Click the OK button.

Case





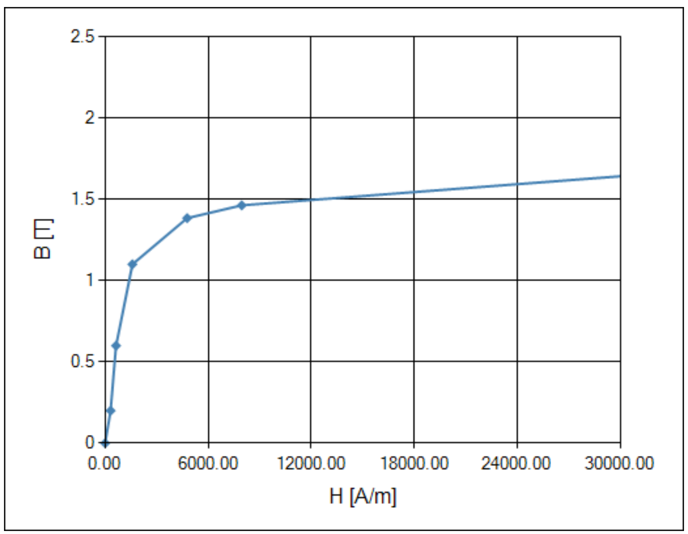
Case setting

1. Case Setting

✓ Part Material : SUS_430

✓ Moving Parts : FIXED (Fixed Component)

[BH Curve]



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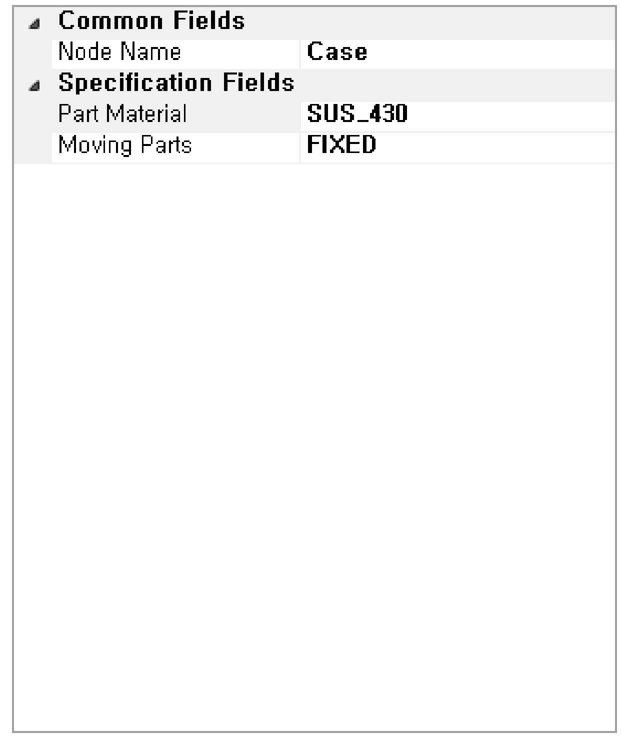
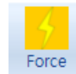


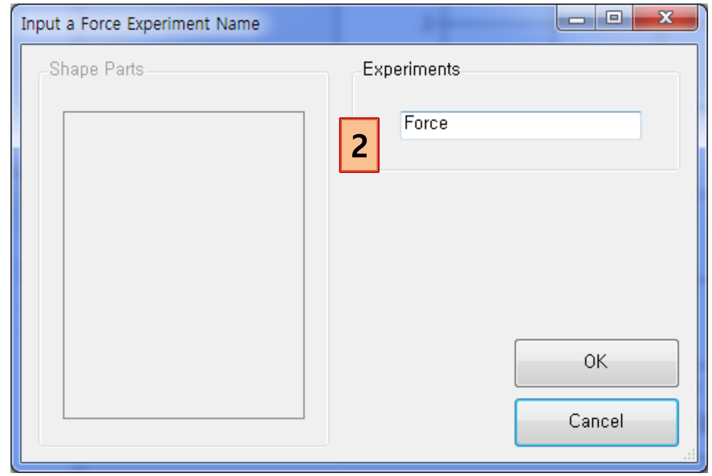
Virtual Experiments

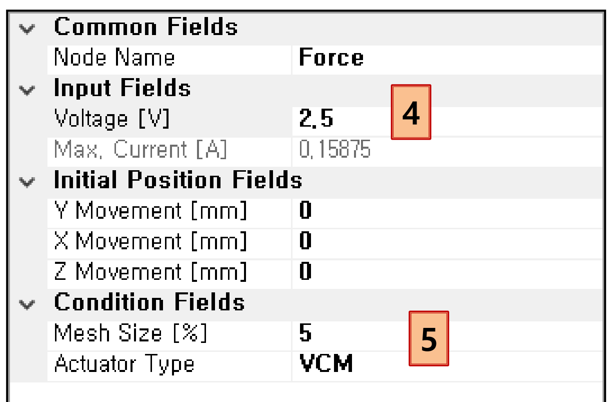
Virtual experiment of magnetic force

1. Toolbar > Click Force Button

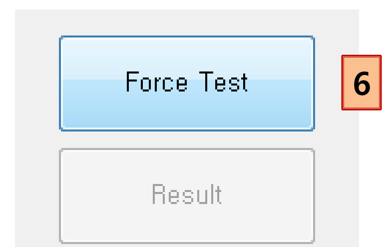


2. Force Experiment Name : "Force"
3. Click OK button
4. Setting of magnetic force experiment
   - ✓ Voltage : 2.5 V
5. Setting of analysis condition
   - ✓ Mesh Size Percent : 5 %
   - ✓ Actuator Type : VCM
6. Click "Force Test" Button



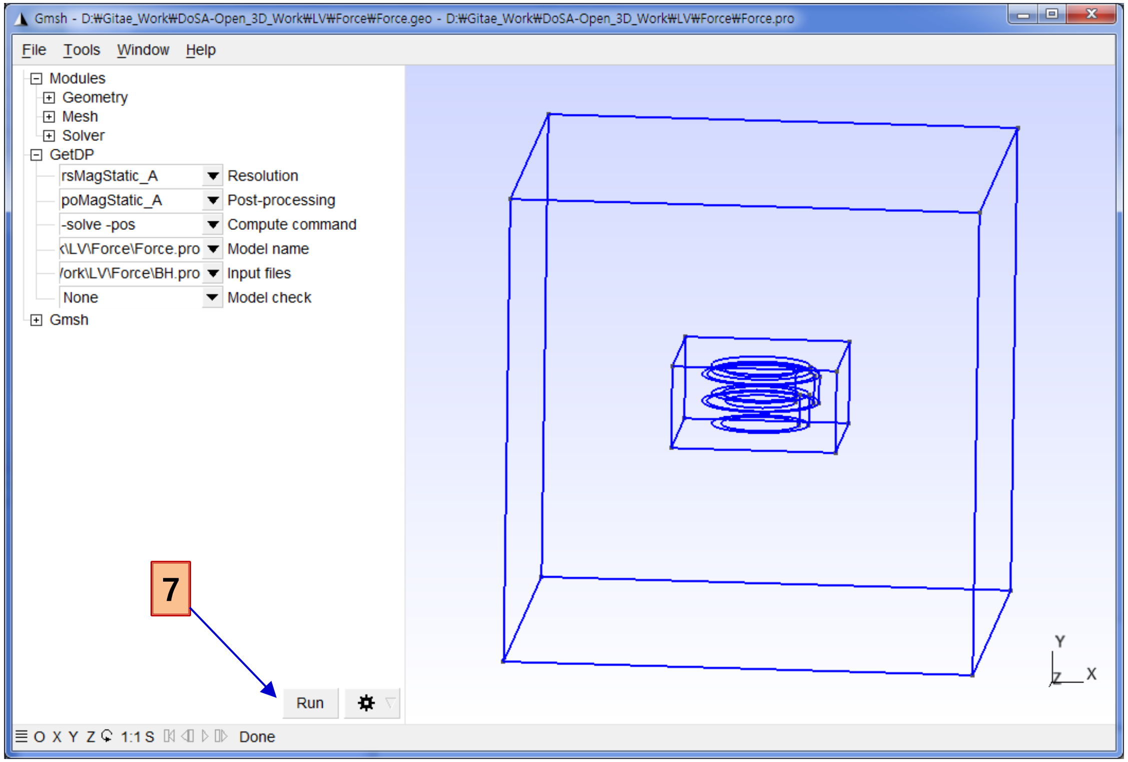


Common Fields	
Node Name	**Force**
Input Fields	
Voltage [V]	**2.5**
Max. Current [A]	0.15875
Initial Position Fields	
Y Movement [mm]	**0**
X Movement [mm]	**0**
Z Movement [mm]	**0**
Condition Fields	
Mesh Size [%]	**5**
Actuator Type	**VCM**



Run the virtual experiment

7. Click the Run button after checking the shape.



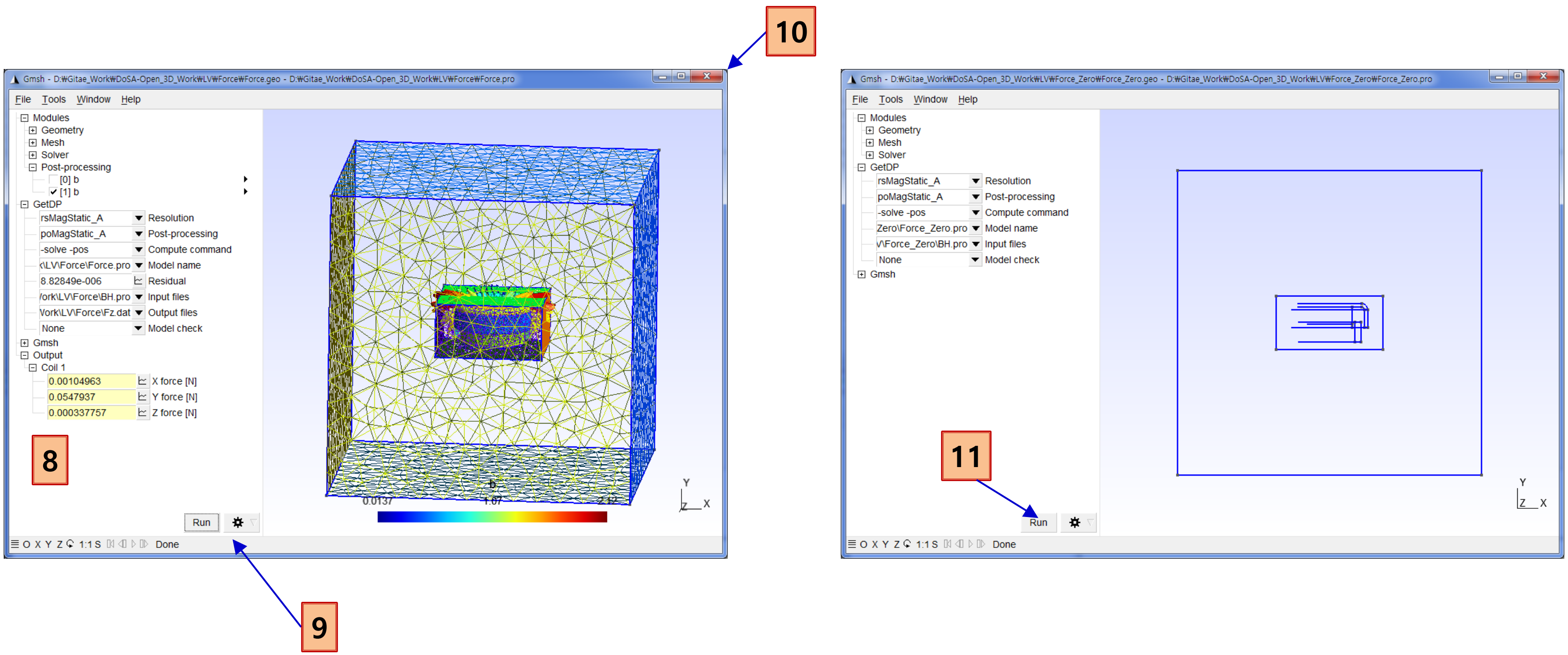
Run the virtual experiment

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

9. **Quit the Gmsh.**

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

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

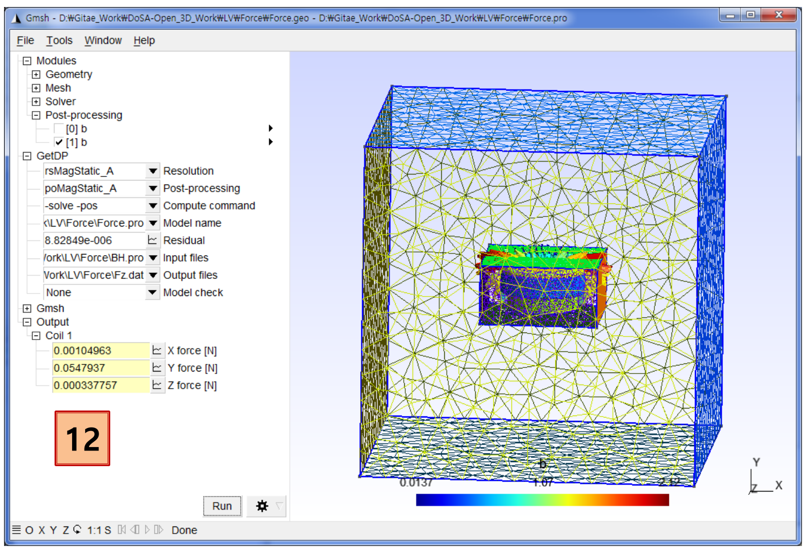


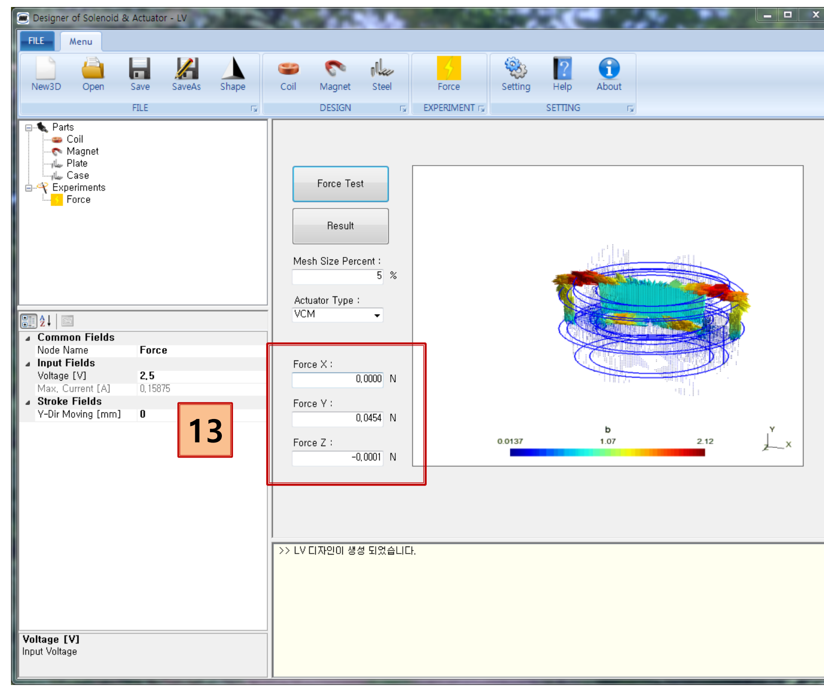
Results of the virtual experiment

12. Quit the Gmsh after checking the analysis results.

13. Check the magnetic force of the VCM.

12





Thank You