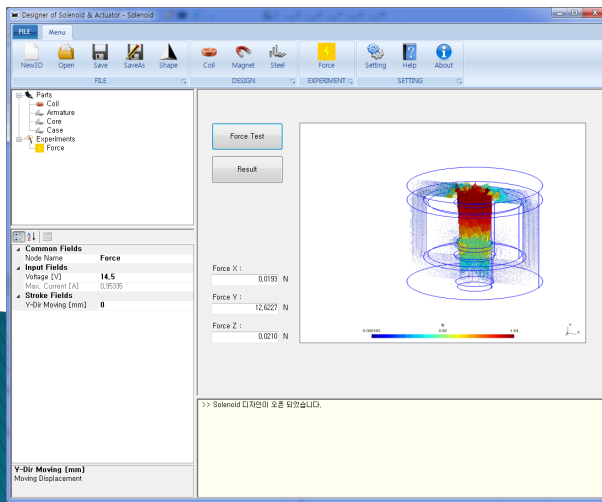


# DoSA-Open\_3D User Manual

## Example of Solenoid



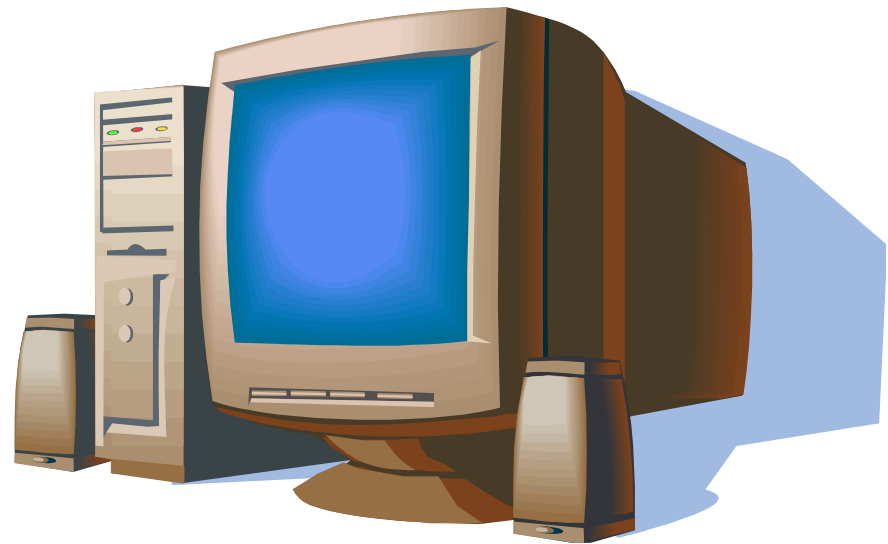
2021-09-23

GiTae Kweon (zgitae@gmail.com)

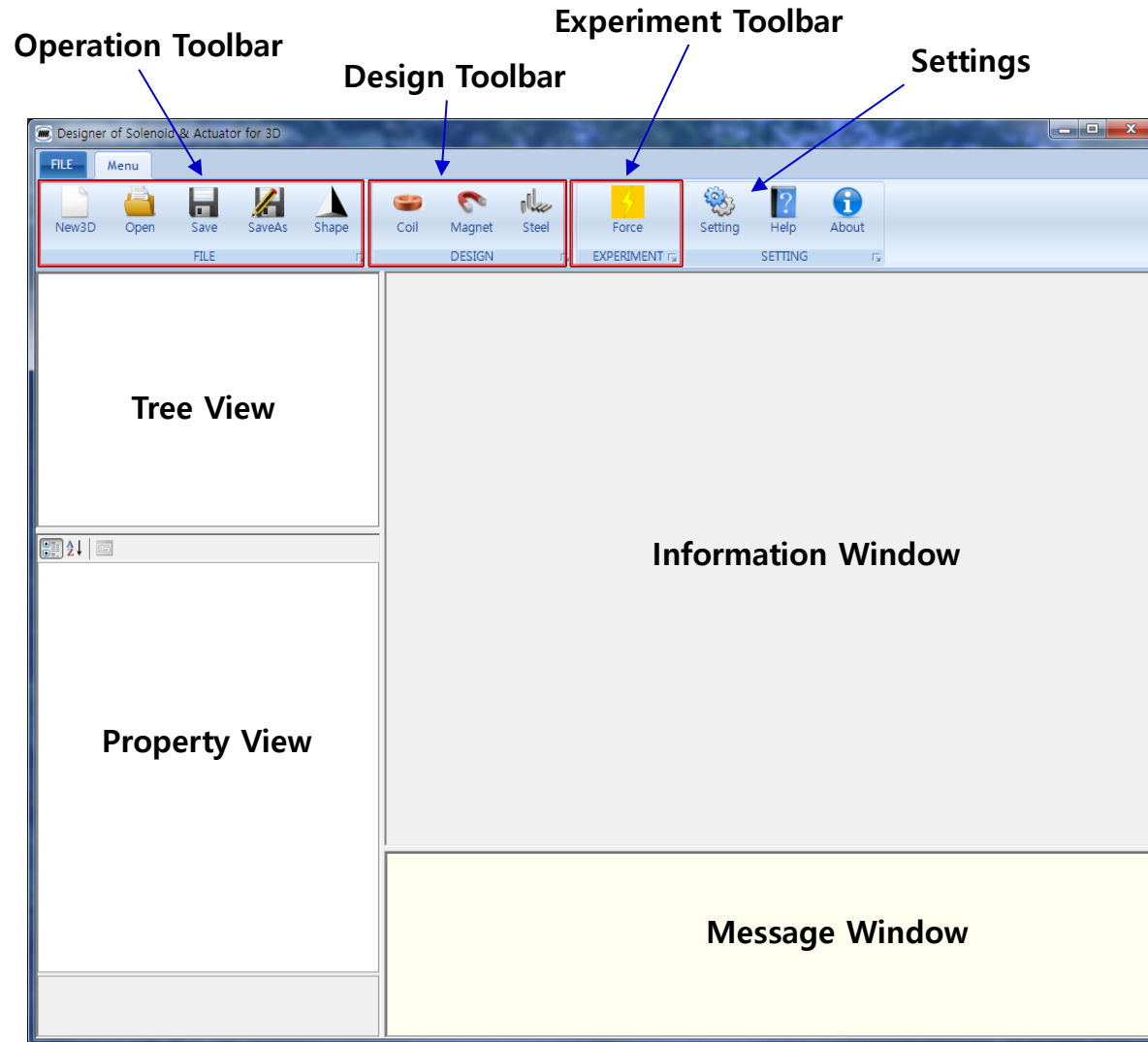
# DoSA Structure

# 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

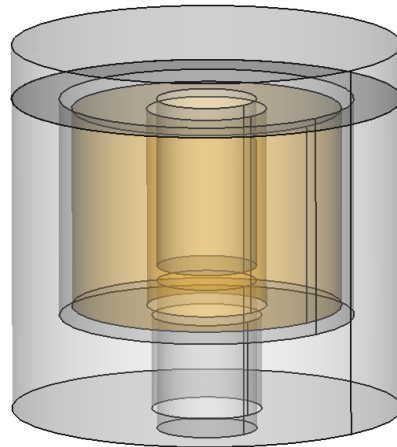
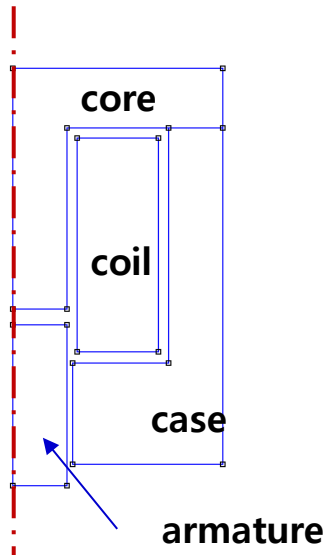
- ✓ Force : Magnetic force estimation for driving part



# Analysis Model

# Analysis Model

## 1. Model Shape



## 2. Product Specifications

### A. Coil Turns

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

### B. Power

- Voltage : 14.5V

( Example Files : DoSA-Open\_3D Install Directory > Samples > Solenoid )

# New design

1. Toolbar > Click New Button



2. Design Name : "Solenoid"

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

## [ Precautions for the Shape Model ]

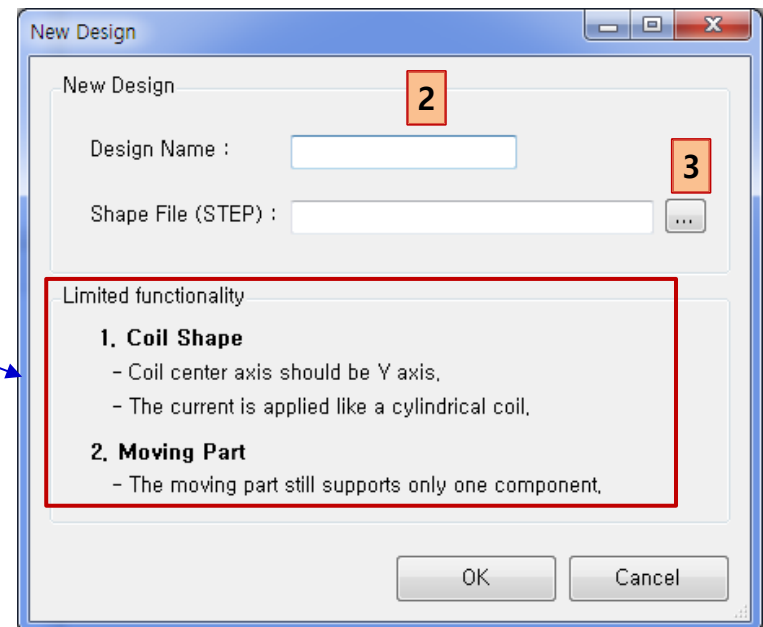
DoSA-Open\_3D still has the following functional limitations.

ㄱ. 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 )

ㄴ. Moving Part

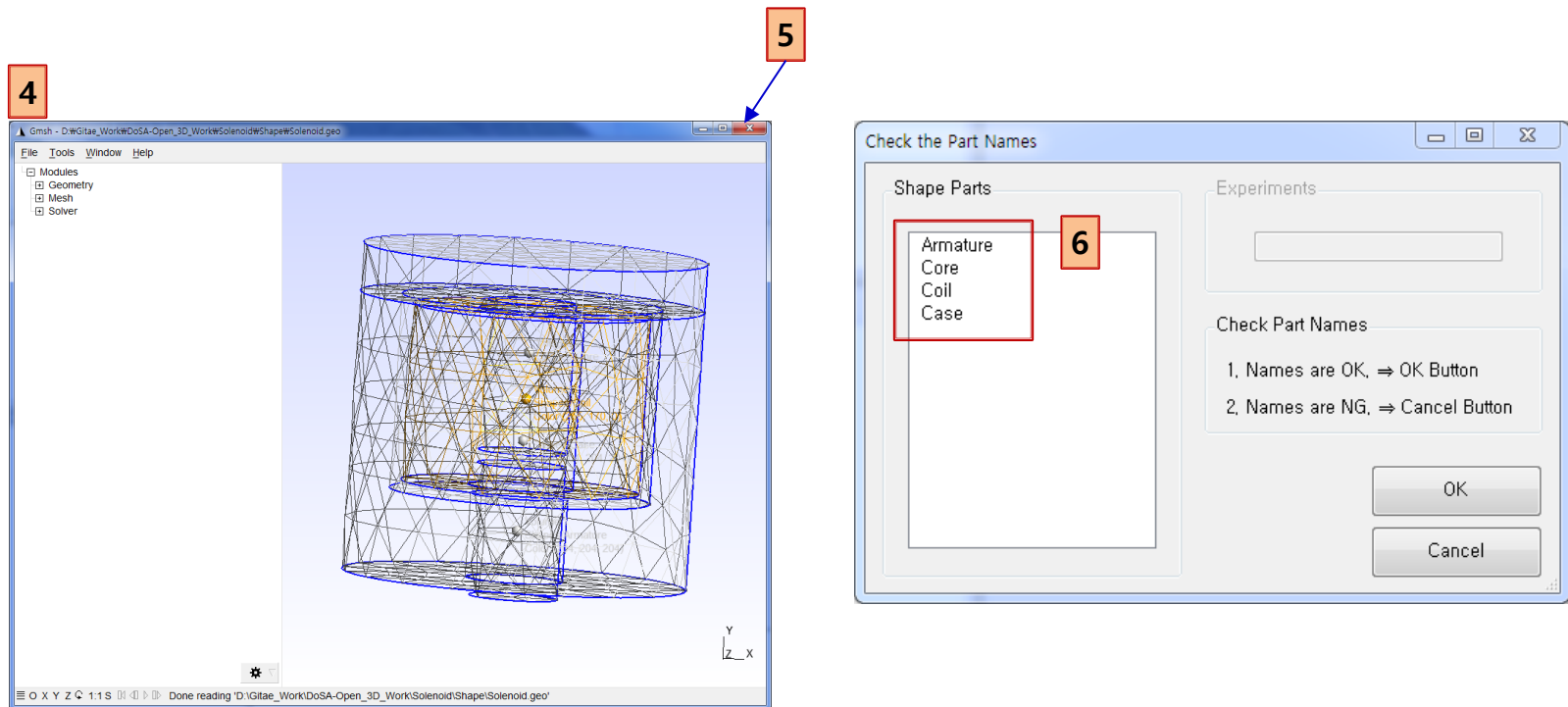
- The moving part still supports only one component..





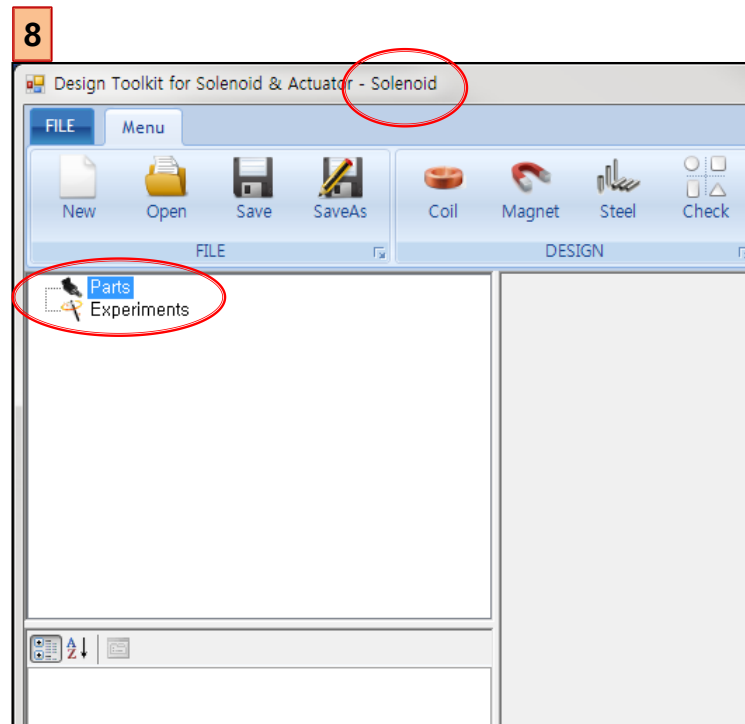
# New design

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

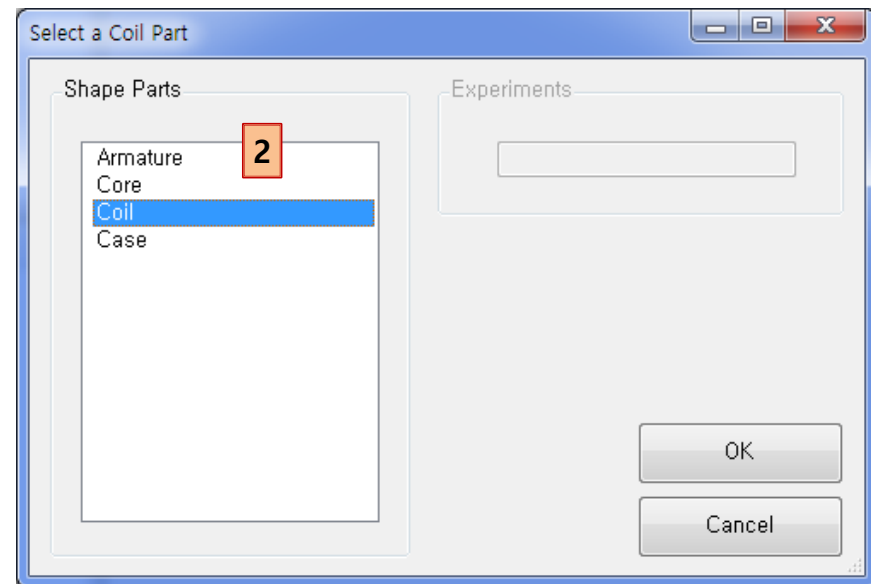
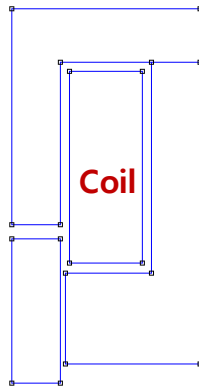
8. Check the design creation.



# 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 Coil specifications

- ✓ Part Material : Copper
- ✓ Current Direction : IN (Inner Direction)
- ✓ Moving Parts : FIXED (Fixed Part)
- ✓ Coil Wire Grade : Enameled\_IEC\_Grade\_2
- ✓ Inner Diameter : 9.6 mm
- ✓ Outer Diameter : 21.6 mm
- ✓ Coil Height : 16 mm
- ✓ 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

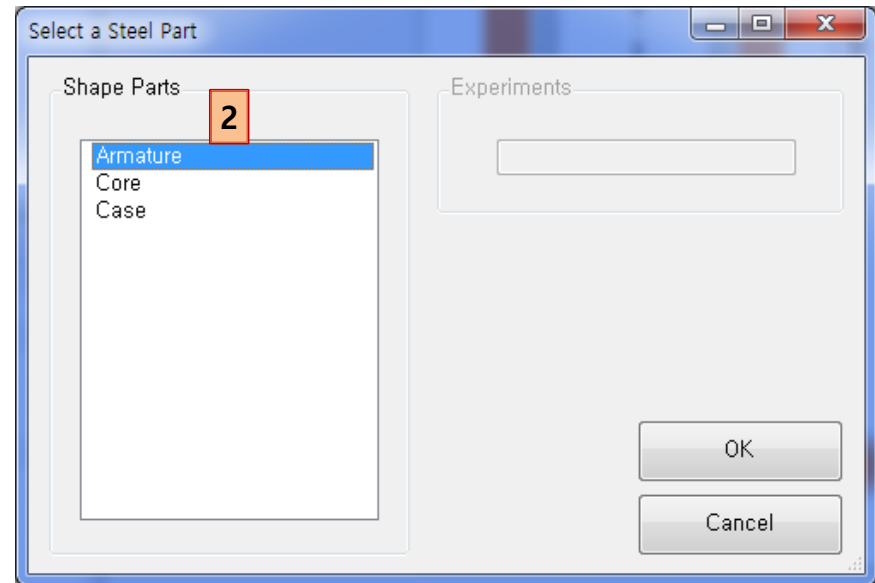
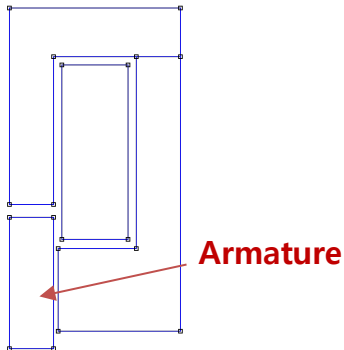
- ✓ Click "Coil Design" button



<b>1</b>	
<b>Common Fields</b>	
Node Name	Coil
<b>Specification Fields</b>	
Part Material	Copper
Current Direction	IN
Moving Parts	FIXED
<b>Calculated Fields</b>	
Coil Turns	1040
Coil Resistance [ $\Omega$ ]	15,20945
Coil Layers	20
Turns of One Layer	52
<b>Design Fields (optional)</b>	
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 Armature

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

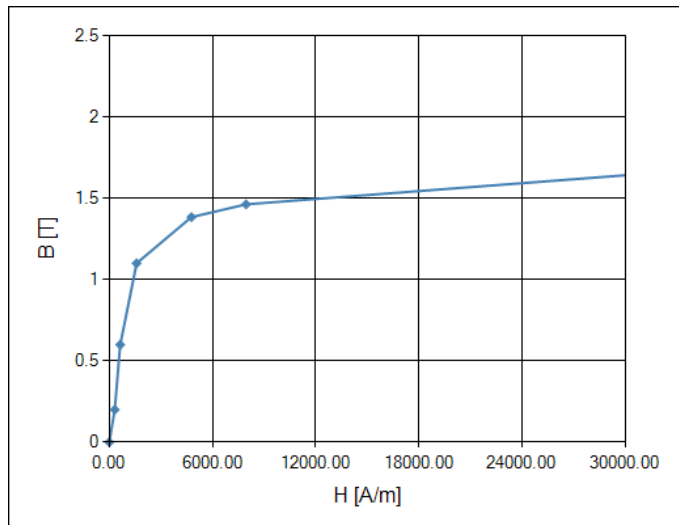


# Armature setting

## 1. Armature setting

- ✓ Part Material : SUS\_430
- ✓ Moving Parts : Moving (Moving Part)

[ BH 곡선 ]

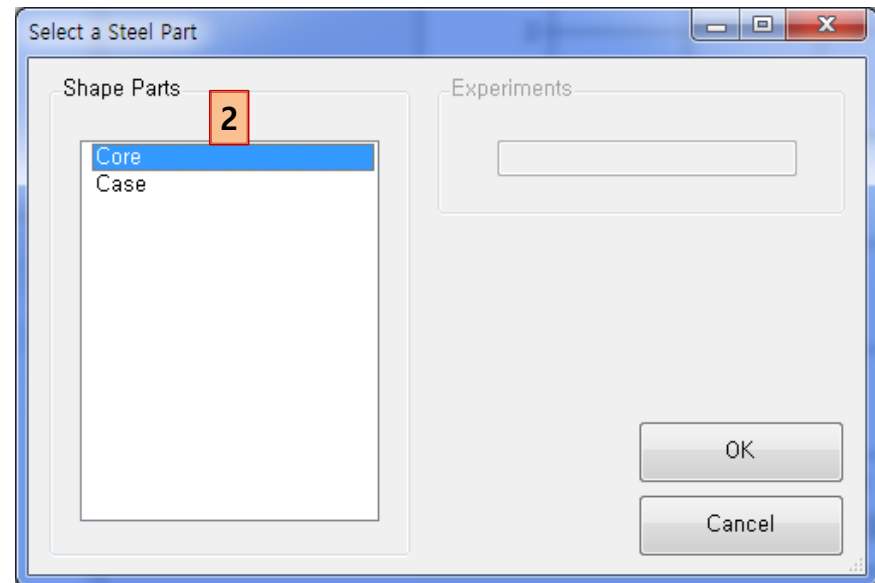
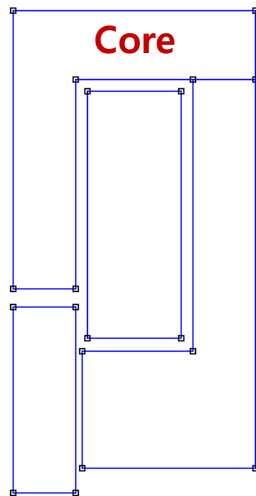


1

Common Fields	
Node Name	Armature
Specification Fields	
Part Material	SUS_430
Moving Parts	MOVING

# Add core

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



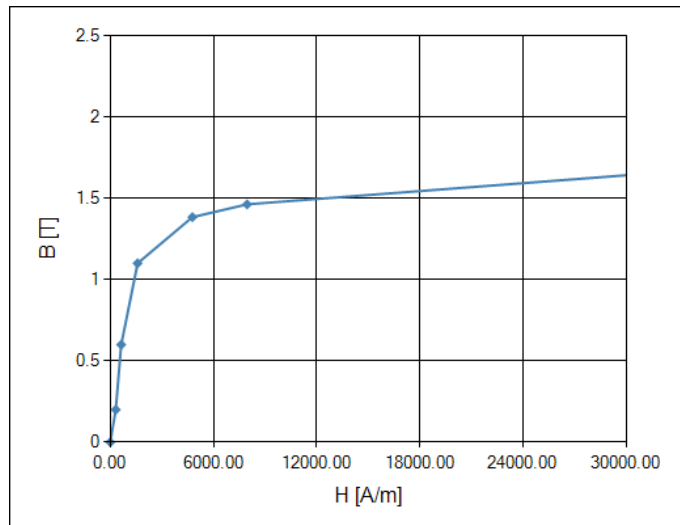


# Core setting

## 1. Core settings

- ✓ Part Material : SUS\_430
- ✓ Moving Parts : FIXED (Fixed Component)

[ BH 곡선 ]

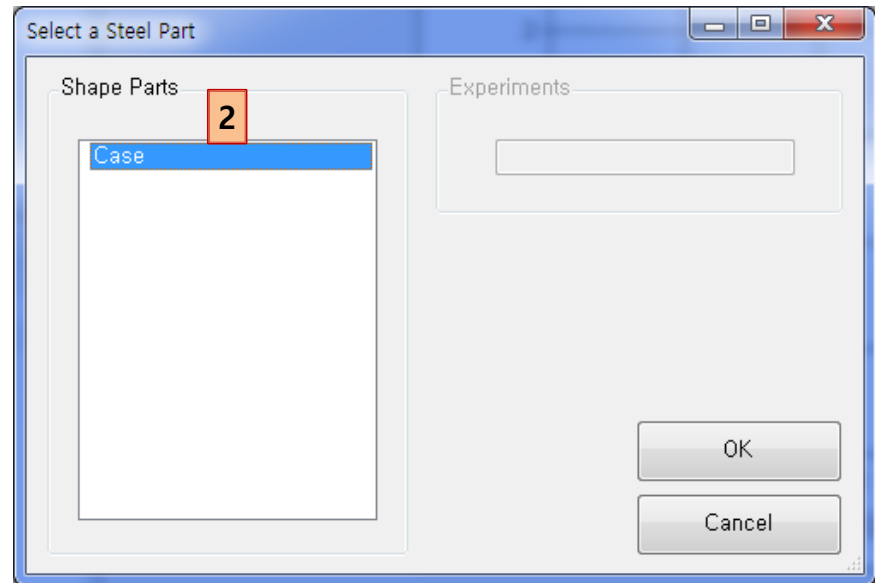
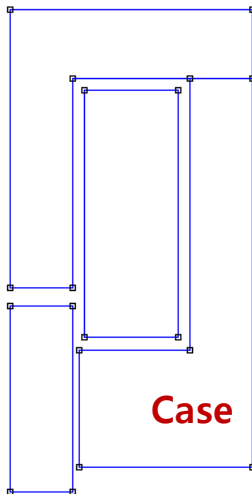


1

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

# Add case

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

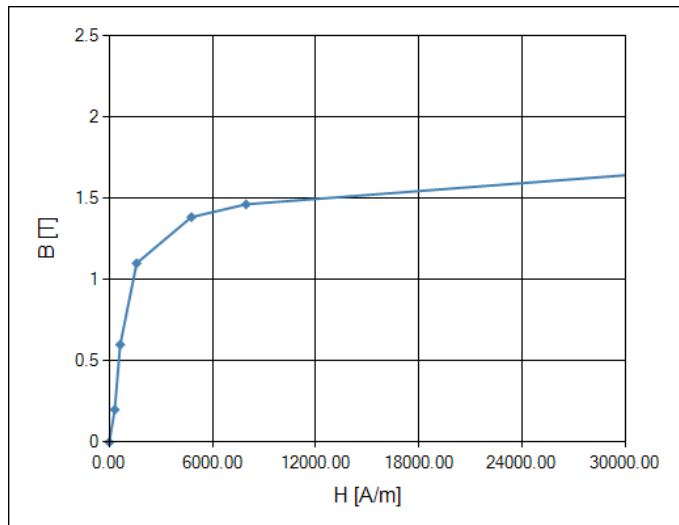


# Case setting

## 1. Case Settings

- ✓ Part Material : SUS\_430
- ✓ Moving Parts : FIXED (Fixed Component)

[ BH 곡선 ]



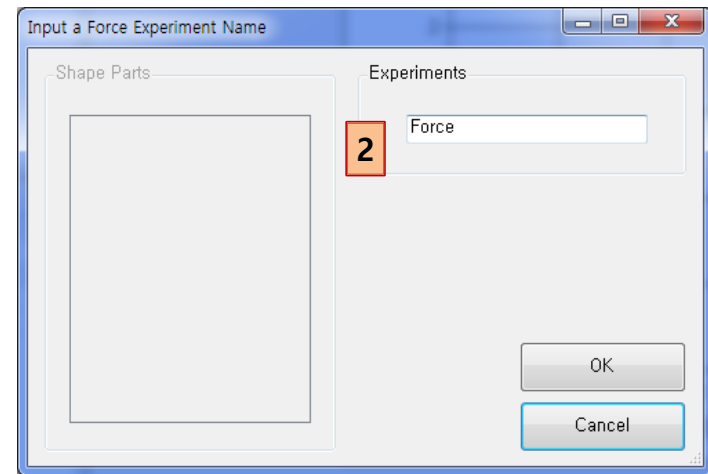
1

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

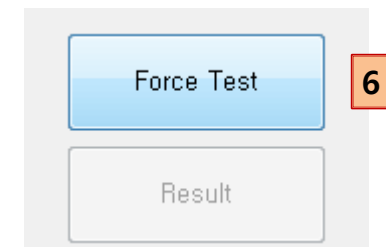
# Virtual Experiments

# 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 : 14.5 V
5. Setting of analysis condition
  - ✓ Mesh Size Percent : 5 %
  - ✓ Actuator Type : Solenoid
6. Click "Force Test" Button

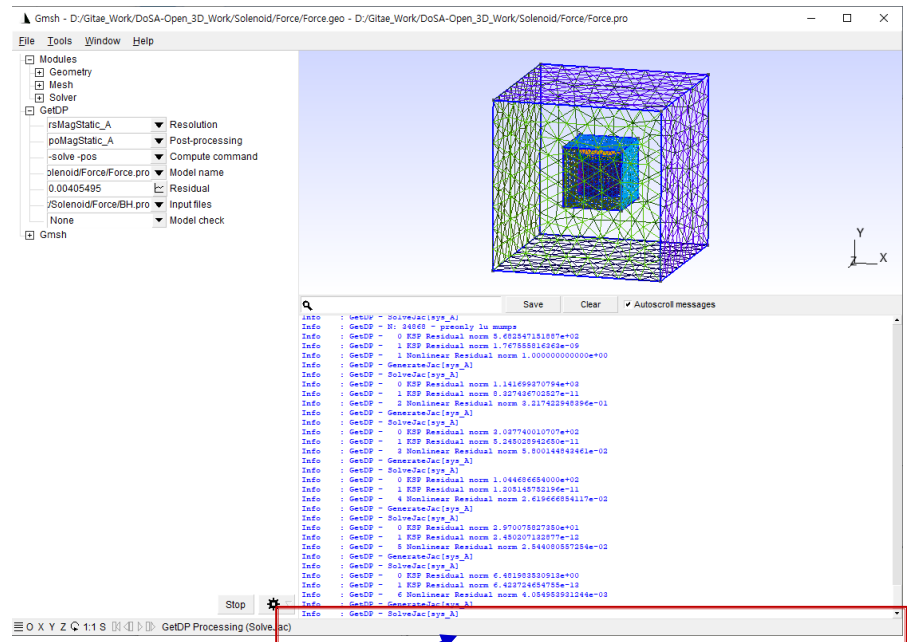
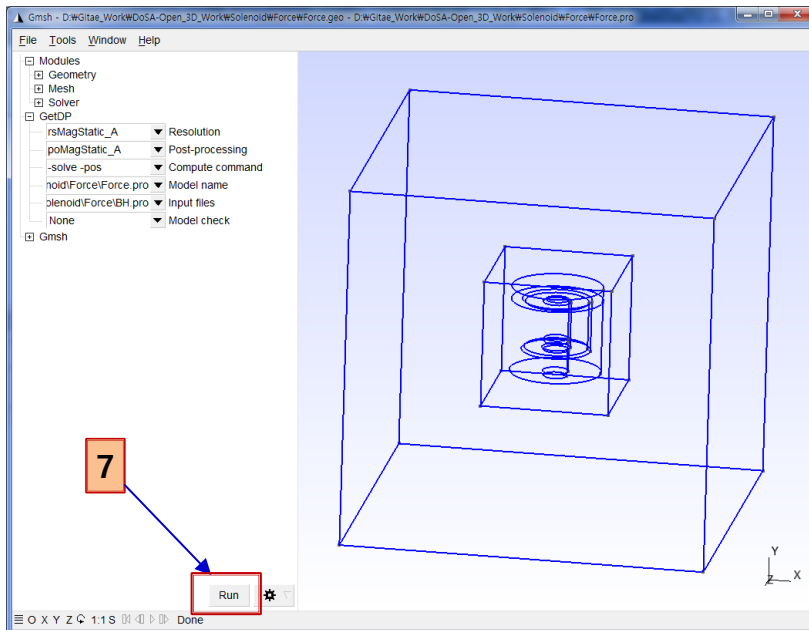


▼ <b>Common Fields</b>	
Node Name	Force
▼ <b>Input Fields</b>	
Voltage [V]	14.5
Max. Current [A]	0.95335
▼ <b>Initial Position Fields</b>	
Y Movement [mm]	0
X Movement [mm]	0
Z Movement [mm]	0
▼ <b>Condition Fields</b>	
Mesh Size [%]	5
Actuator Type	Solenoid



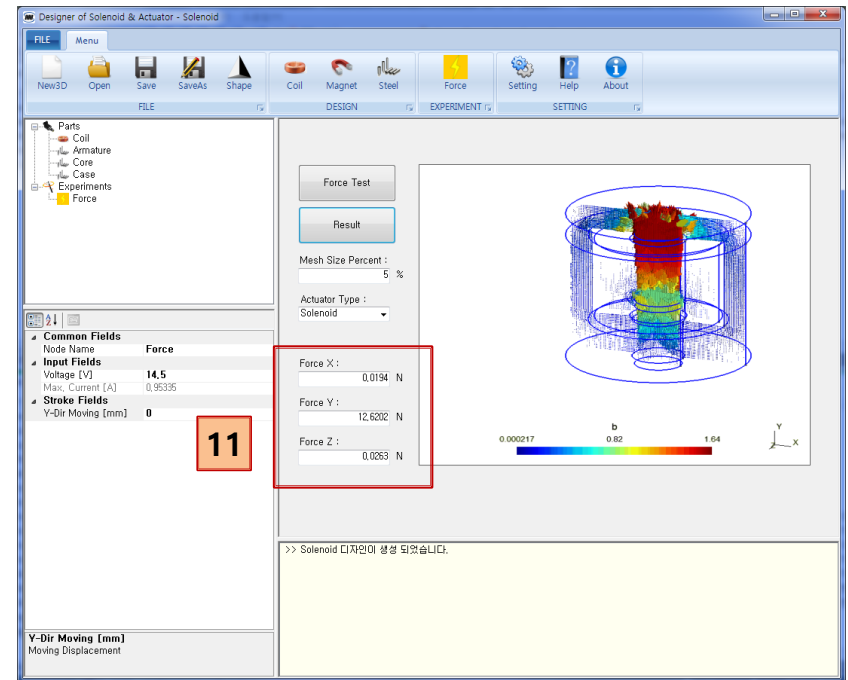
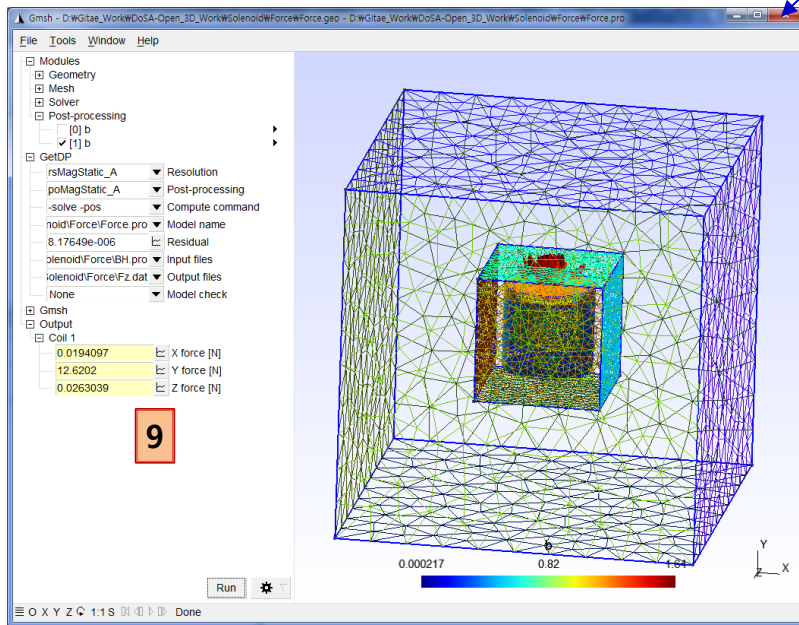
# Run the virtual experiment

- Click the Run button after checking the shape.
- If you want to see the analysis progress, click the status bar of the Gmsh.



# Results of the virtual experiment

9. Check the analysis results after solving. (The solving time is depend on you system specification)
10. **Quit the Gmsh.**
11. Check a magnetic force of the solenoid.



# Thank You

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Homepage : <http://openactuator.org>

