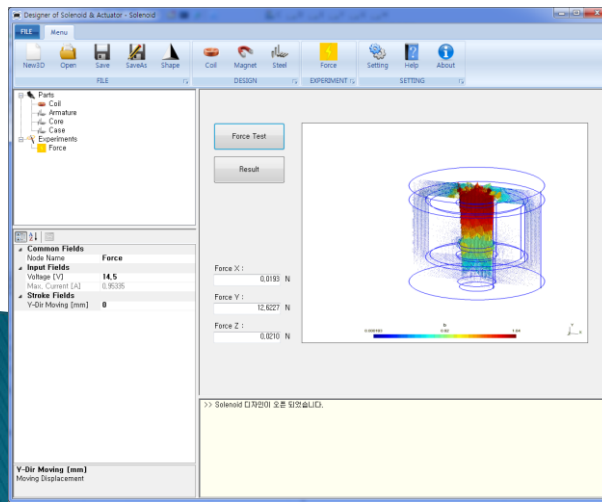


# DoSA-3D User Manual

## Solenoid Example



2022-03-19

GiTae Kweon (zgitae@gmail.com)

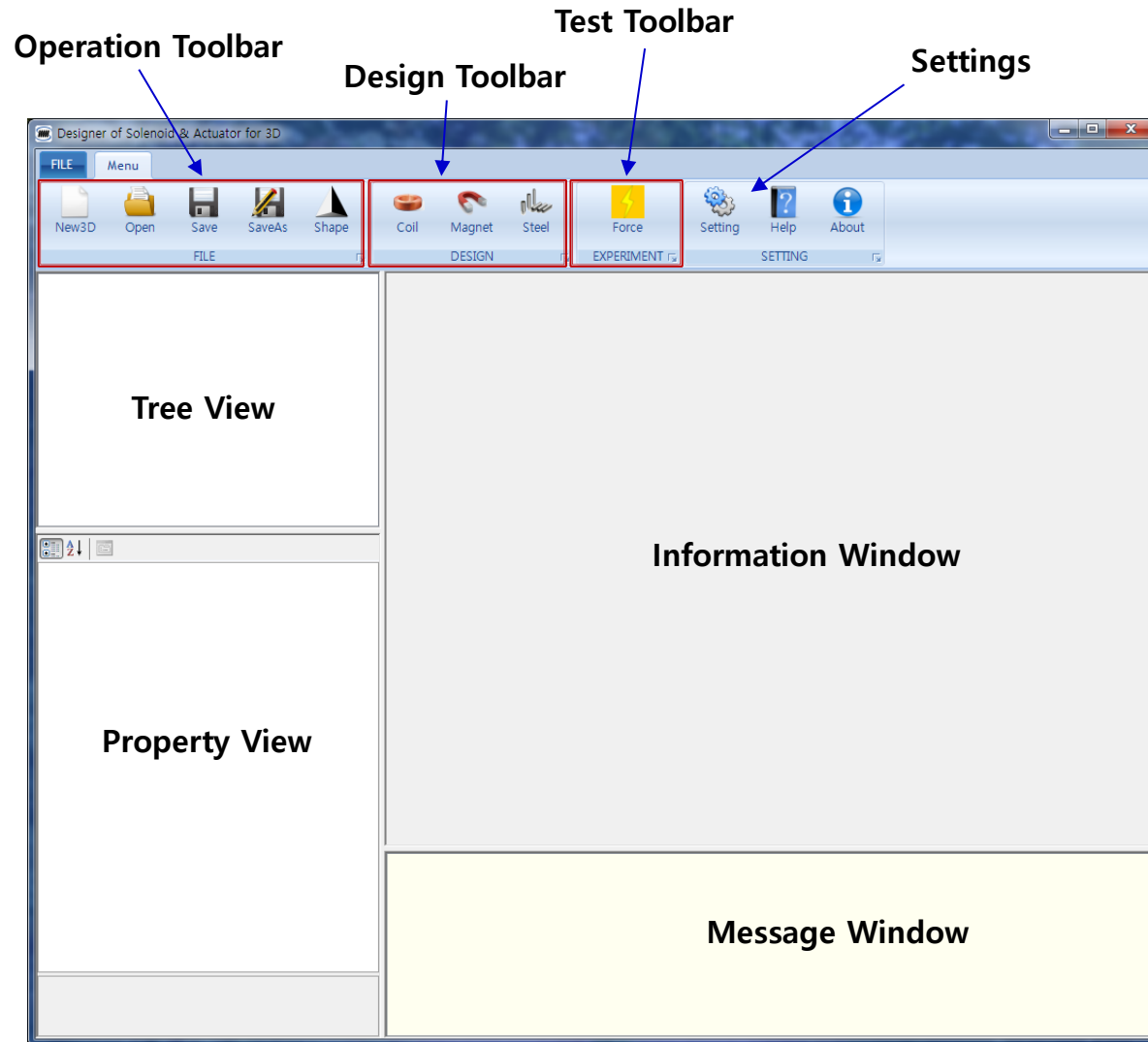
# DoSA Structure

# PC Requirement

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



# Program Structure



# Toolbar

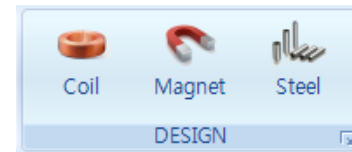
## 1. Operations

- ✓ 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. Virtual Test

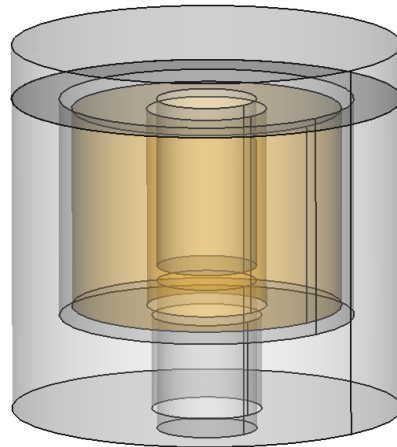
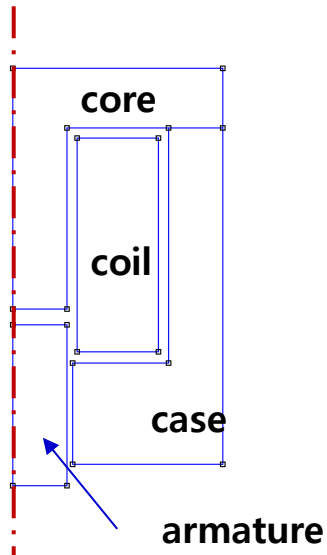
- ✓ Force : Magnetic force estimation



# Analysis Model

# Analysis Model

## 1. Model Shape



Solenoid.step

## 2. Product Specifications

### A. Coil Turns

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

### B. Power

- Voltage : 14.5V

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

# New design

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



## [ Precautions for the Shape Model ]

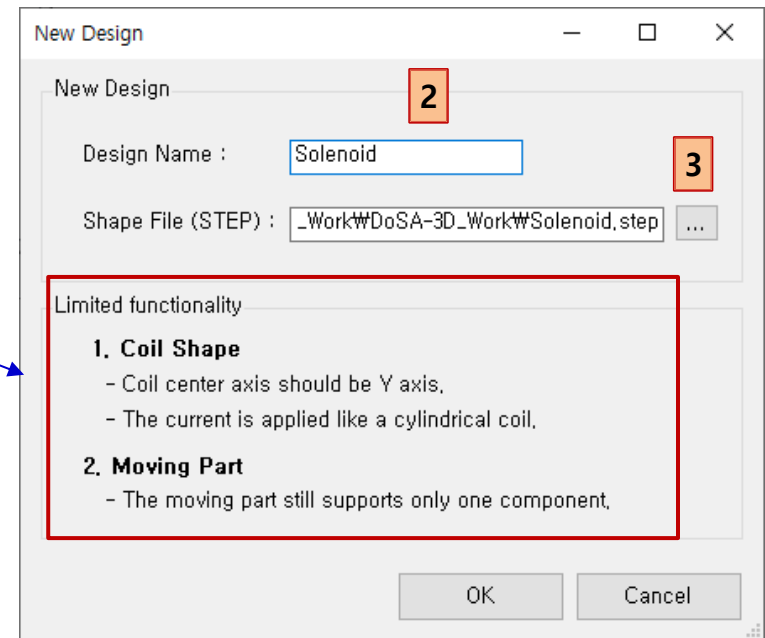
DoSA-3D still has the following functional limitations.

### 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

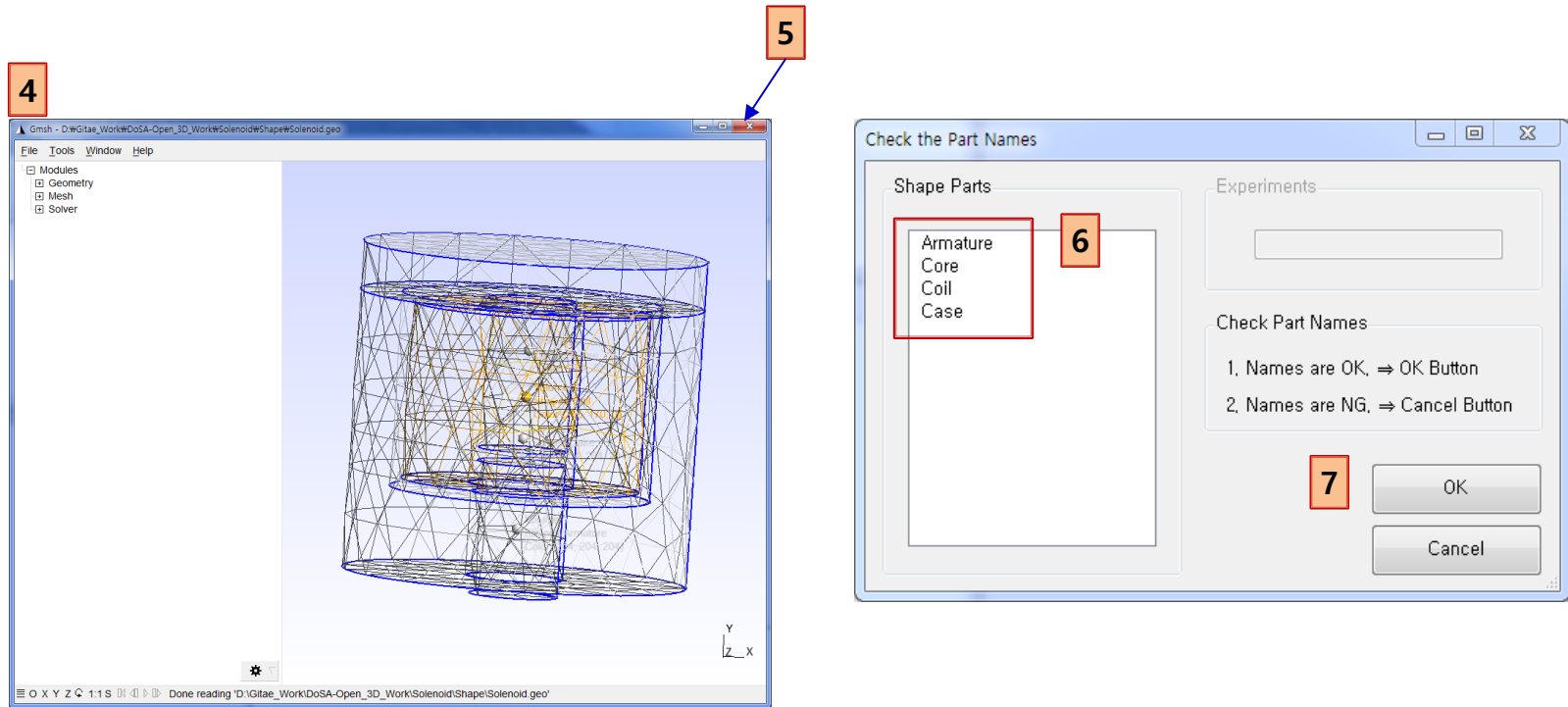
- The moving part still supports only one component..





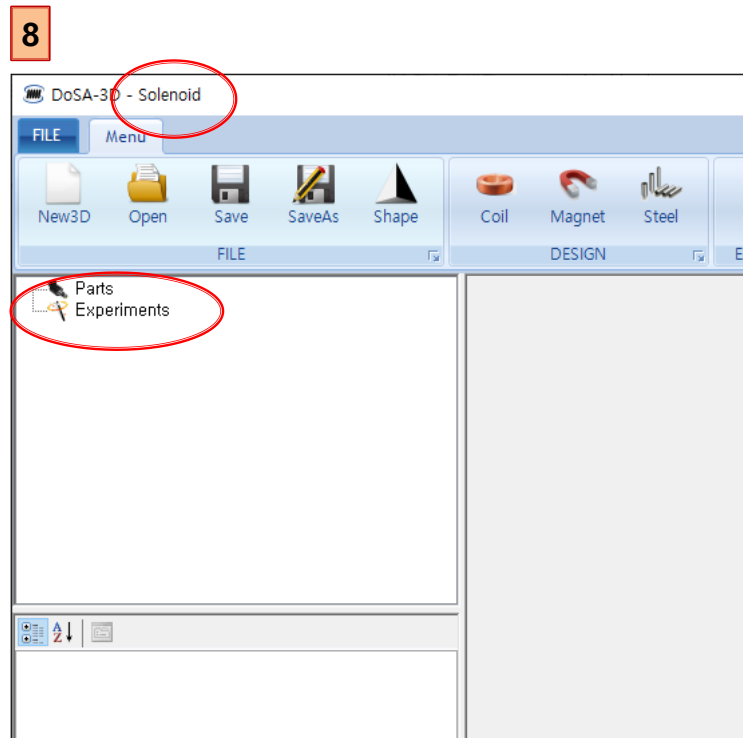
# New design

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

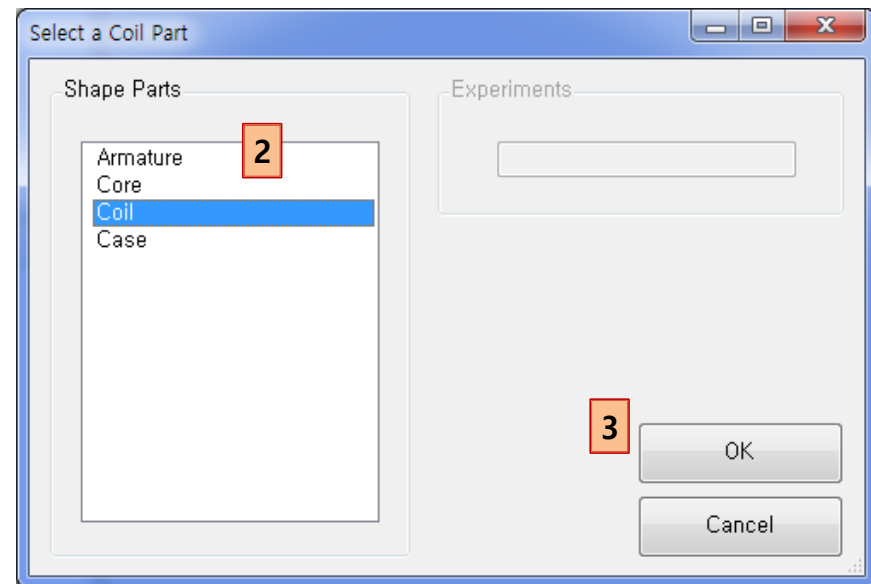
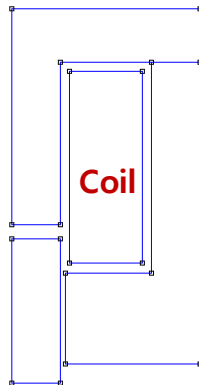
8. Check the design creation.



# Parts Design

# Add a Coil

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



# Coil design

## 1. Input Coil specifications

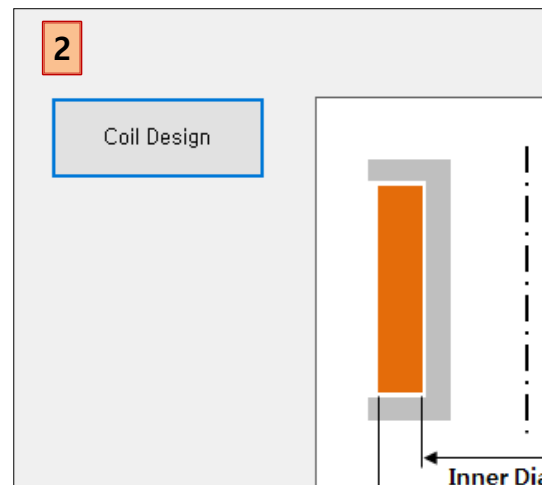
- ✓ Inner Diameter : 9.6
- ✓ Outer Diameter : 21.6
- ✓ Coil Height : 16
- ✓ Copper Diameter : 0.27

## 2. Calculate the coil specification

- ✓ Click "Coil Design" button

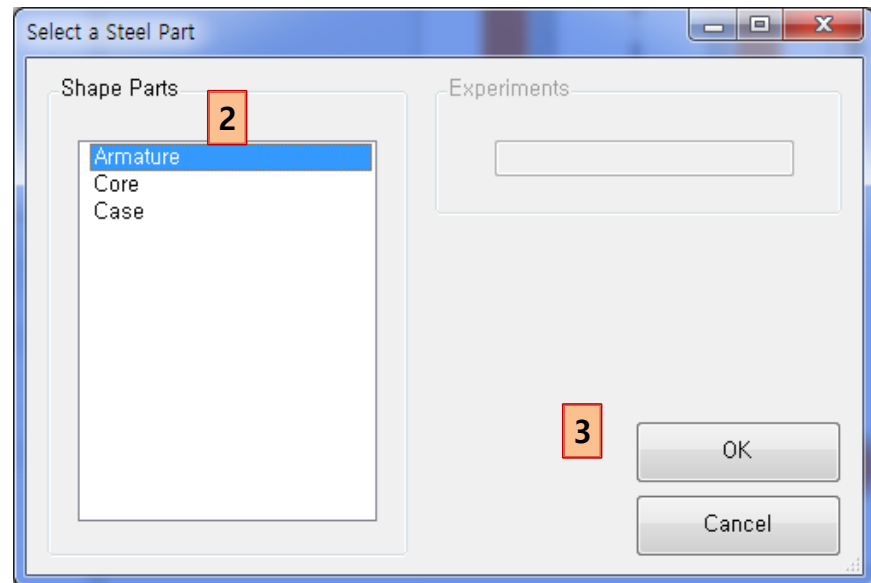
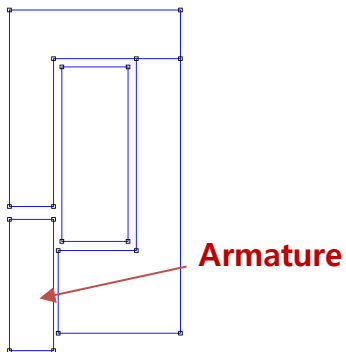
## 3. Check the coil specification

Common Fields	
Node Name	Coil
Specification Fields	
Part Material	Copper
Curent Direction	IN
Moving Parts	FIXED
Calculated Fields	
Coil Turns	1040
Coil Resistance [ $\Omega$ ]	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 an Armature

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

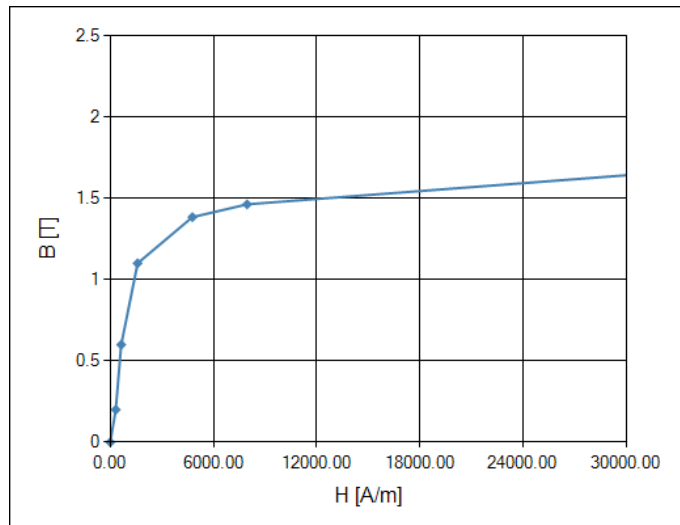


# Armature setting

## 1. Armature setting

- ✓ Part Material : SUS\_430
- ✓ Moving Parts : **MOVING**

[ BH 곡선 ]

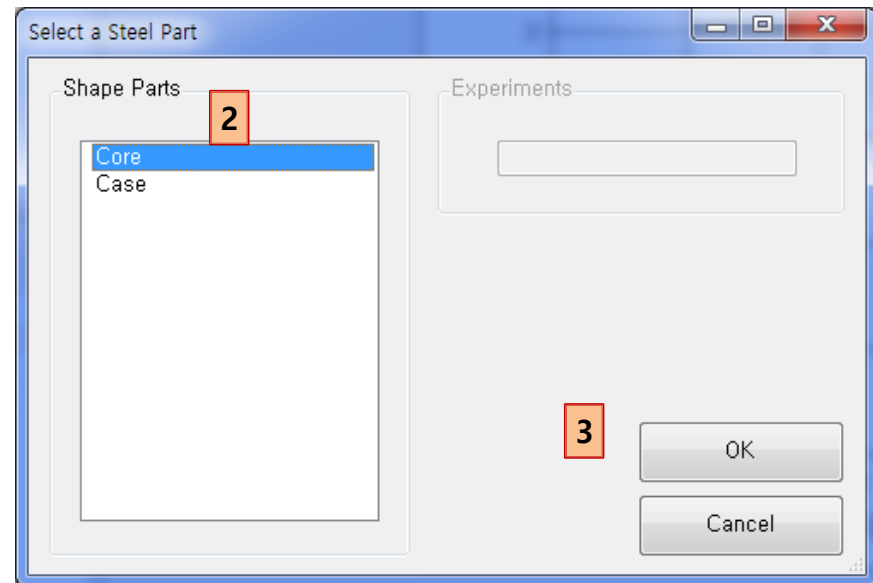
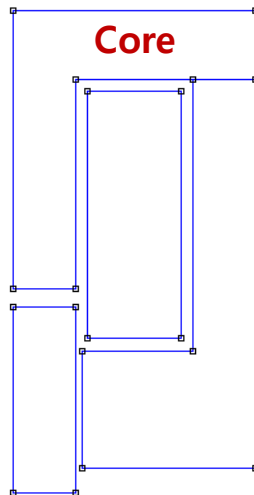
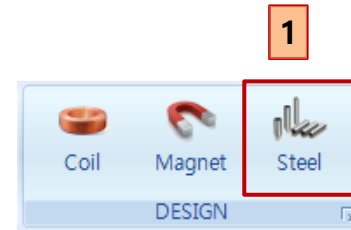


1

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

# Add a core

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



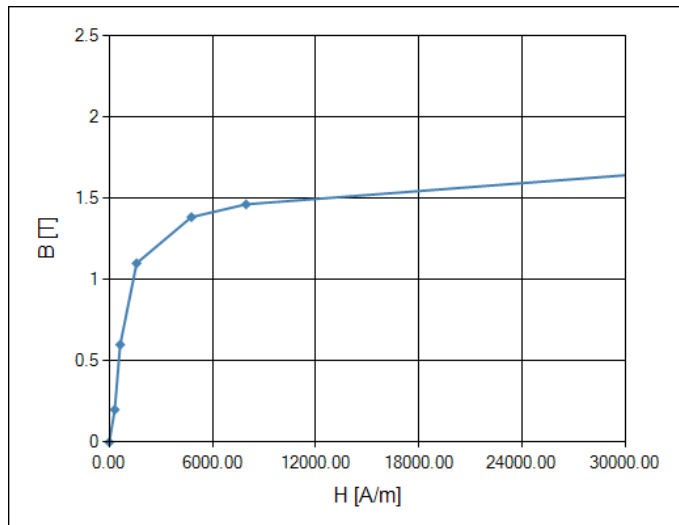


# Core setting

## 1. Core settings

- ✓ Part Material : SUS\_430

[ BH 곡선 ]

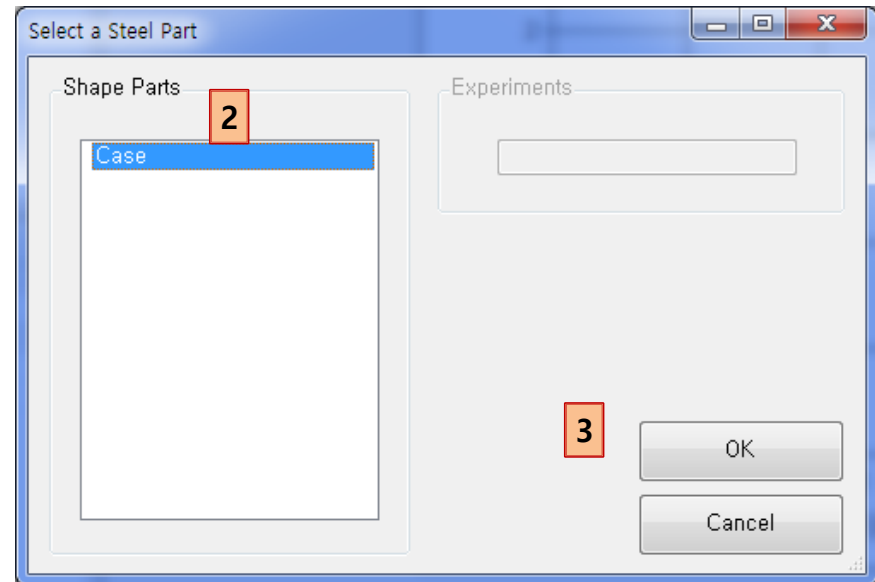
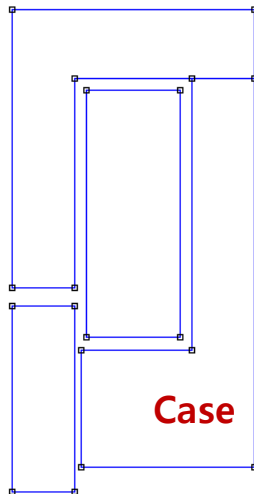
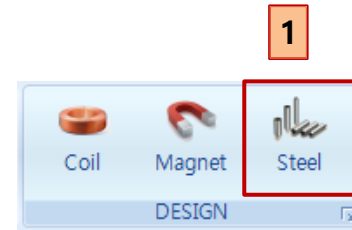


1

Common Fields	
Node Name	Core
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.

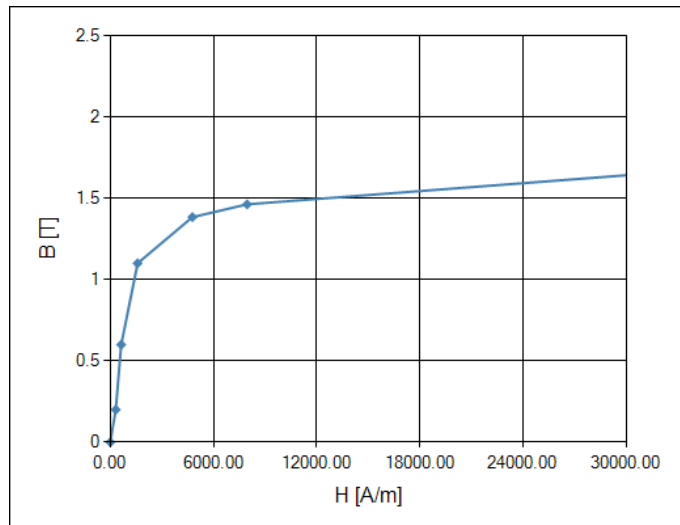


# Case setting

## 1. Case Settings

✓ Part Material : SUS\_430

[ BH 곡선 ]



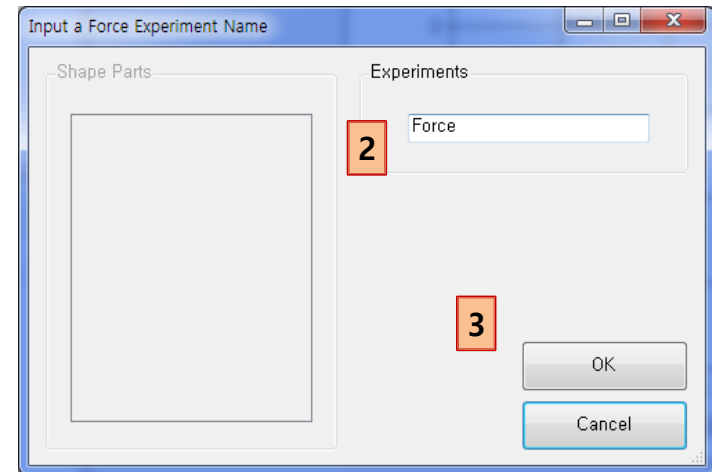
1

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

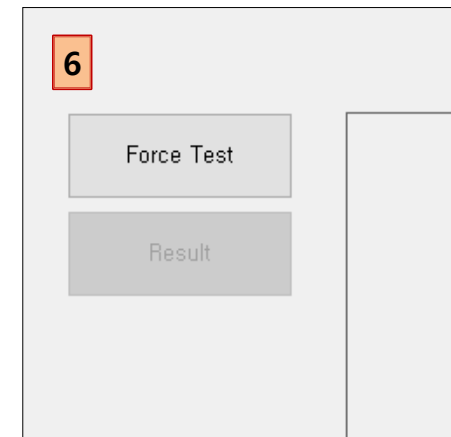
# Virtual Test

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

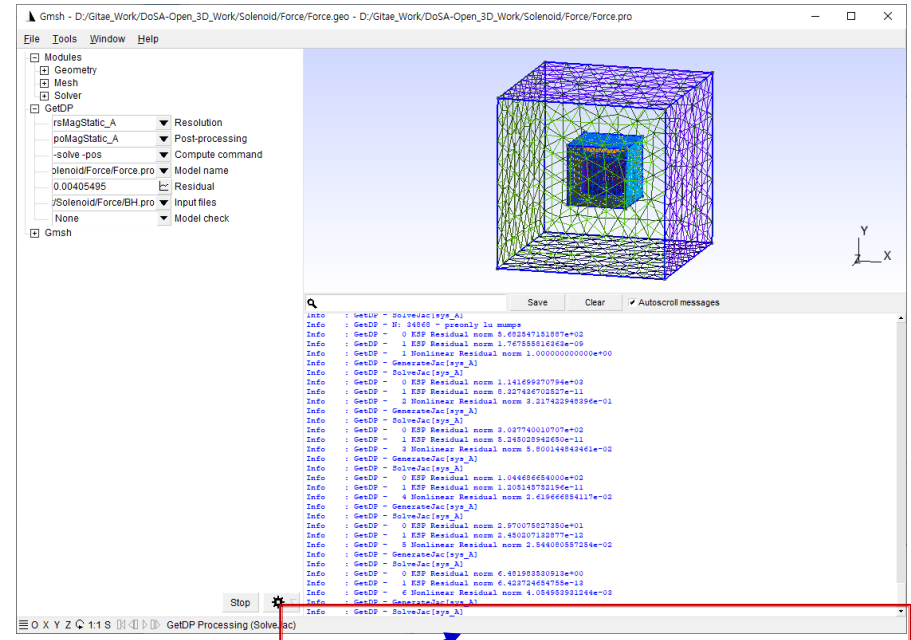
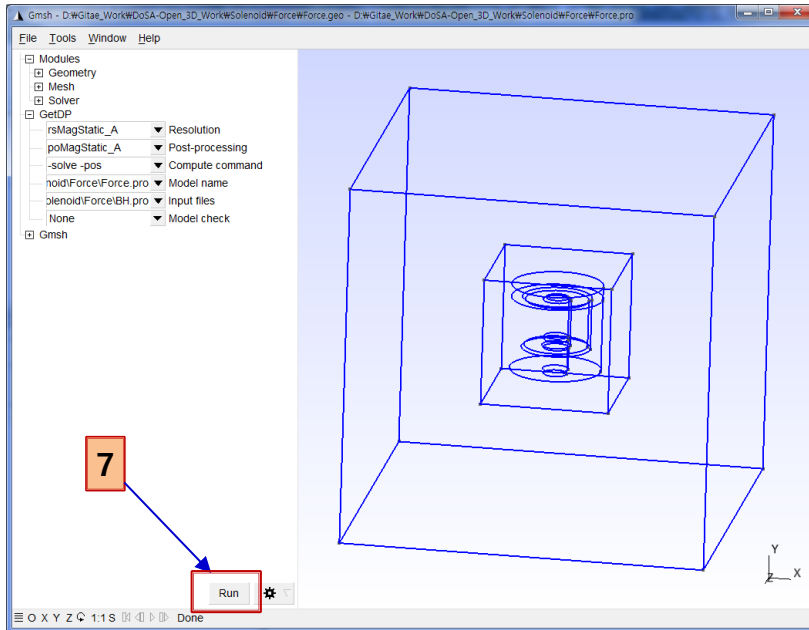


▼ <b>Common Fields</b>	
Node Name	Force
▼ <b>Input Fields</b>	
Voltage [V]	14.5
Max. Current [A]	0,95335
▼ <b>Initial Position Fields</b>	
Y Movement [mm]	0
X Movement [mm]	0
Z Movement [mm]	0
▼ <b>Condition Fields</b>	
Mesh Size [%]	5
Actuator Type	Solenoid



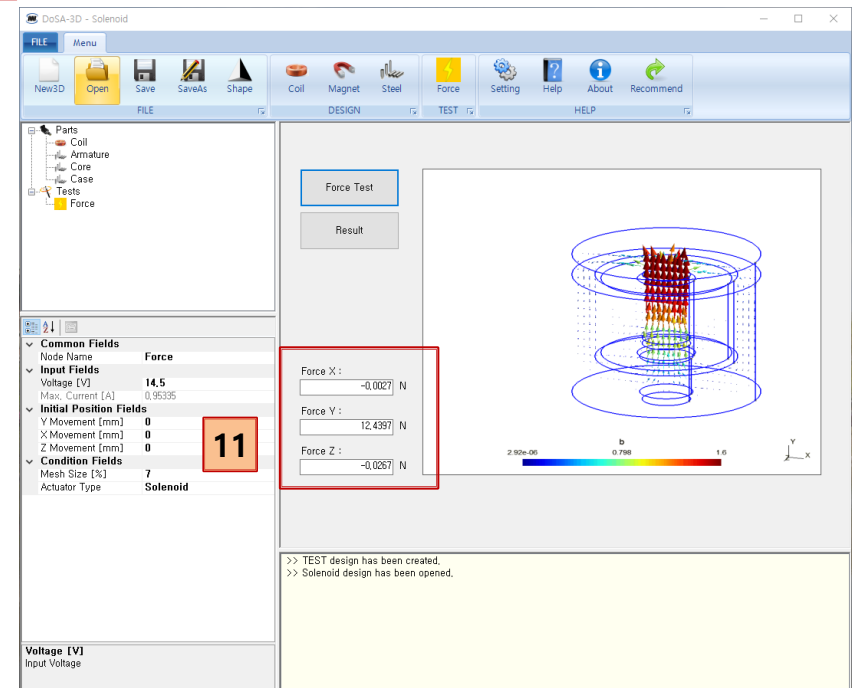
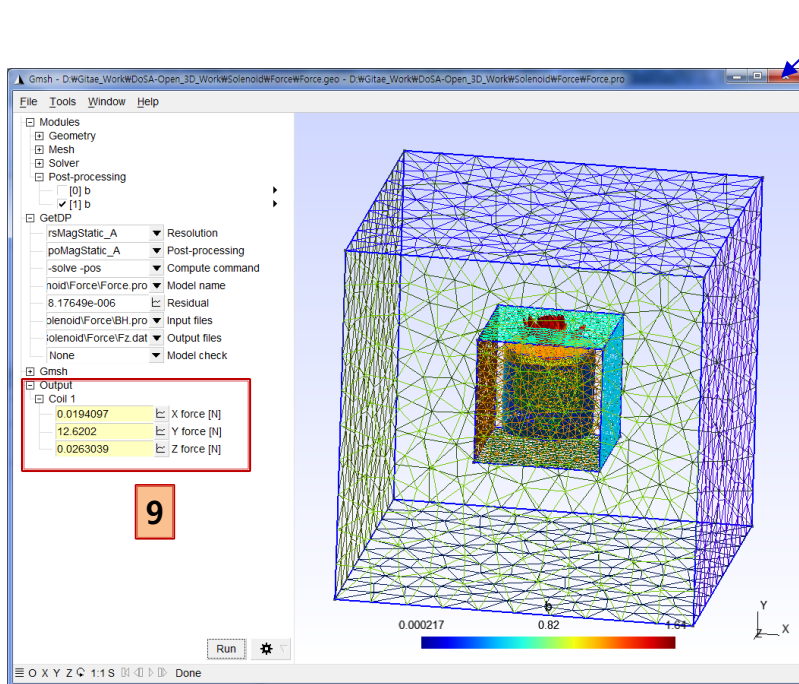
# Run the virtual test

- 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 test

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.

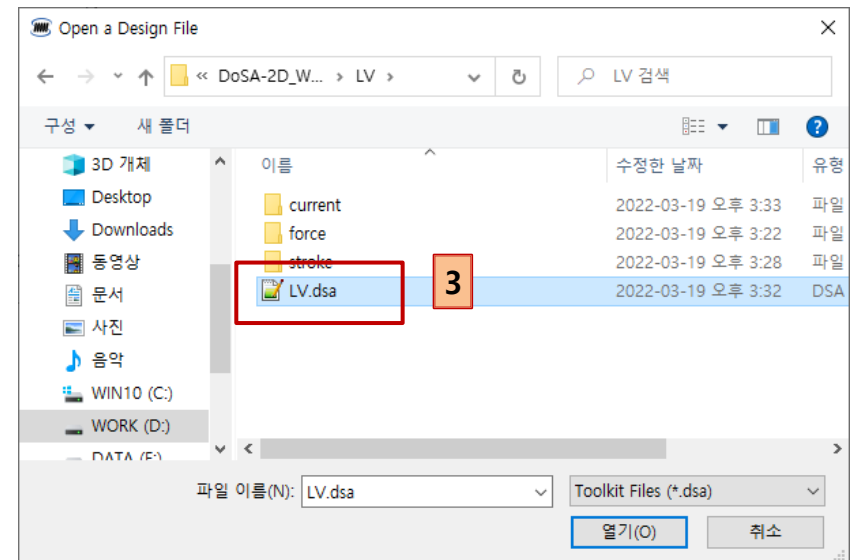
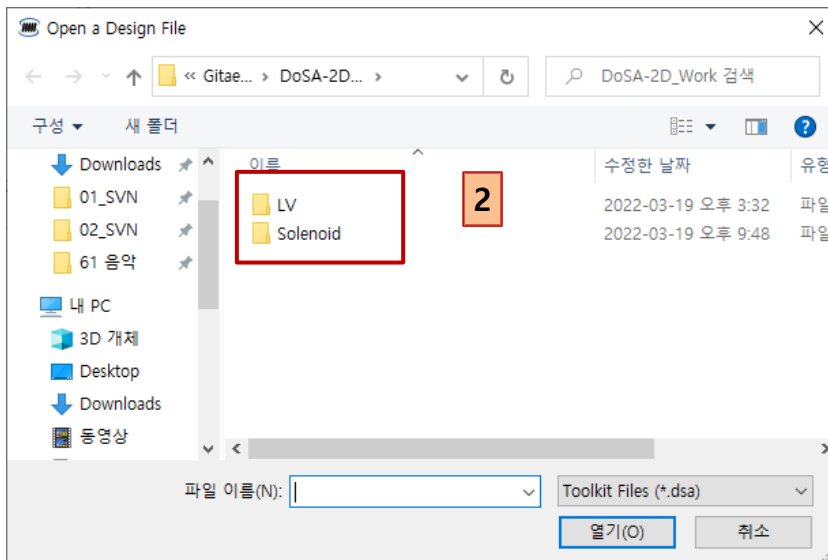
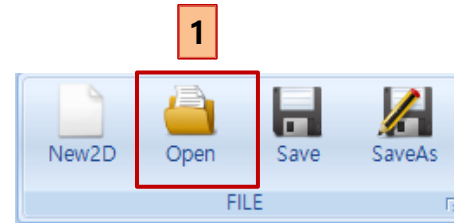


Tips



# 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>

