Actuator-CAT 실습 초급

Linear Vibrator (VCM) 성능 해석

EBU | ㈜태성에스엔이

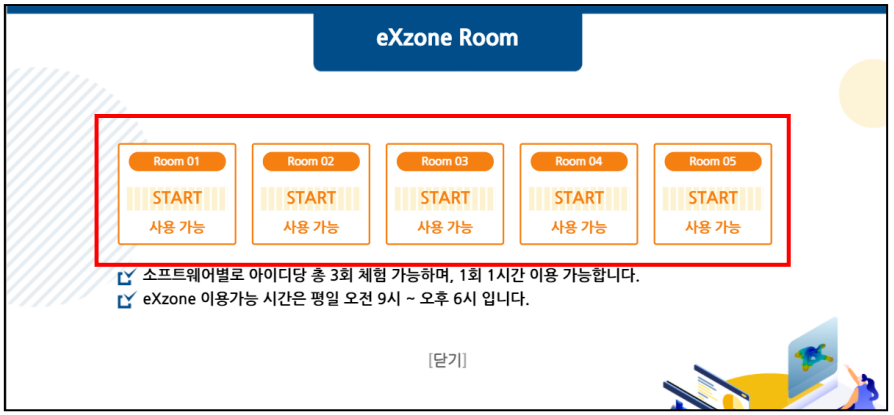
Contents

01 체험존 실행 및 예제 소개

Actuator-CAT 체험존 실행 방법

1. **eXzone Room 실행**
   - Room 버튼 클릭
   - 사용시간 : 평일 9시 ~ 18시
2. **Actuator-CAT 2D 실행**
   - Actuator-CAT 2D-Starter 버튼 클릭
   (실행 : 1분 소요됨)
3. **Actuator-CAT 확인**

1



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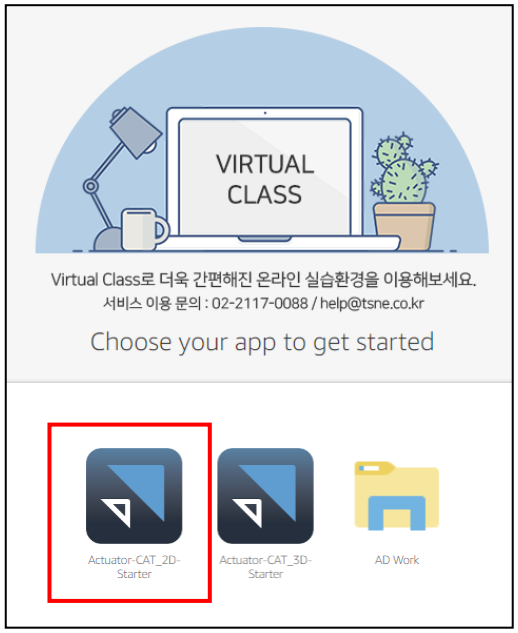

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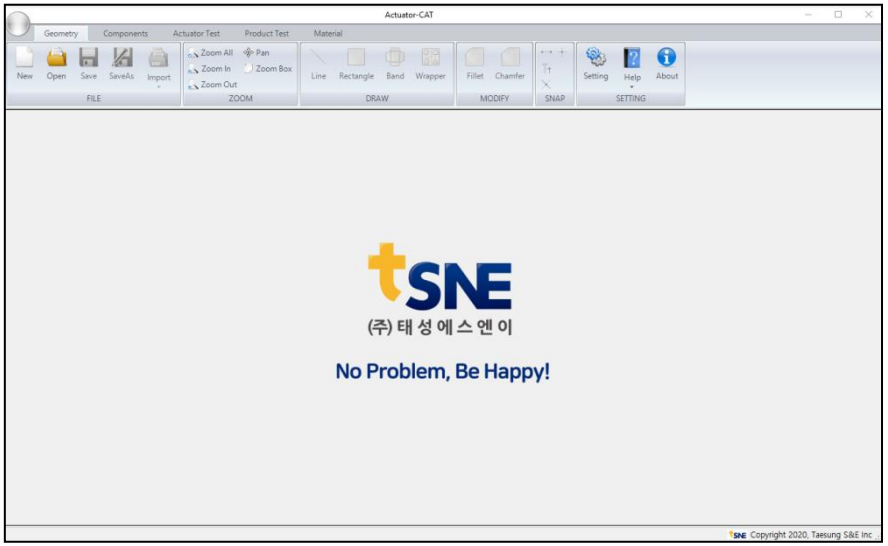
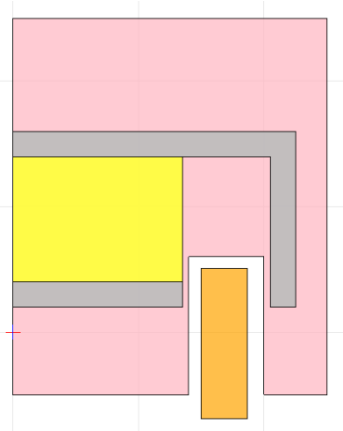
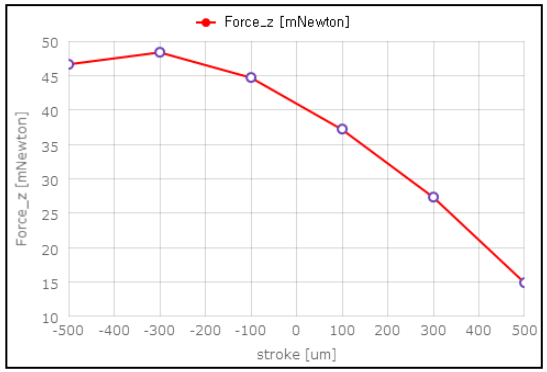
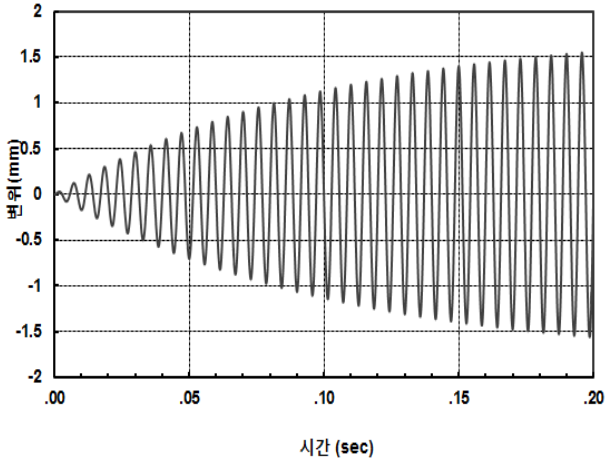


예제 모델 설명

- **예제 아이템**
  - Linear Vibrator : 공진을 이용하여 진동력을 발생시키는 VCM
- **해석 목적**
  - 전류나 변위별 자기력 해석
  - VCM 구동자의 시간에 대한 거동 해석





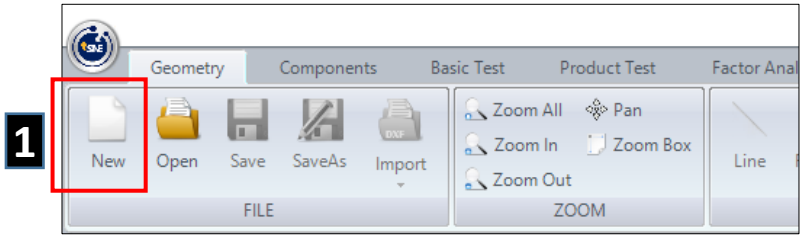


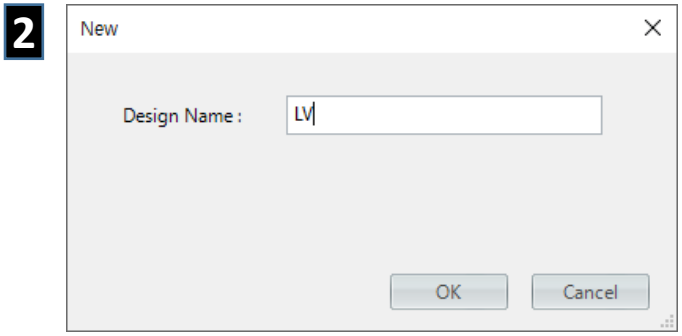
02 형상 작업

- 단계 설명 : 2D 형상 작업
- 작업 내용 : 2D Modeling or DXF Import

디자인 생성

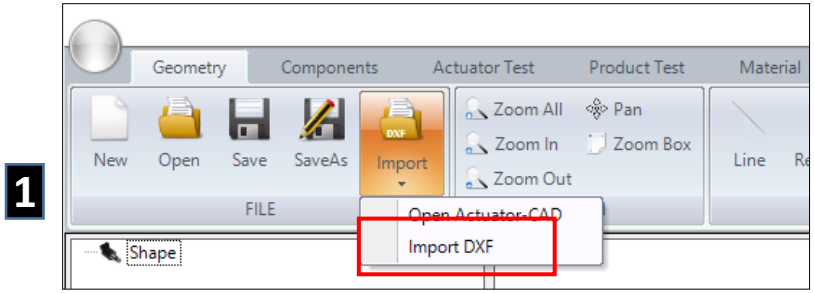
1. Toolbar > New 버튼 클릭
2. Design 명 입력
   - LV
3. OK 버튼

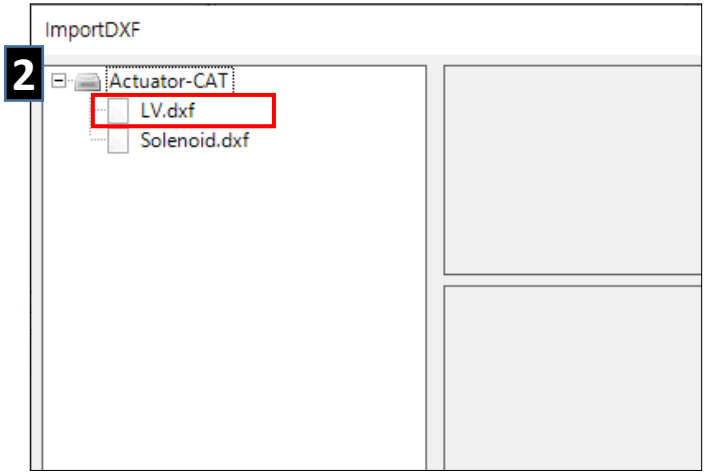


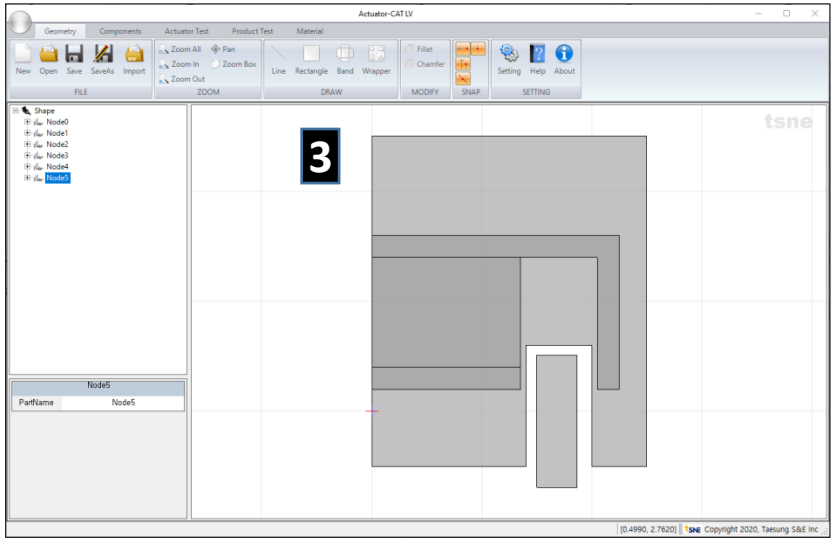


형상 Import

1. **형상 Import**
   - Toolbar > Import 클릭
2. **Import DXF 선택**
   - LV.dxf 선택 후 열기 버튼 클릭
3. **형상 확인**

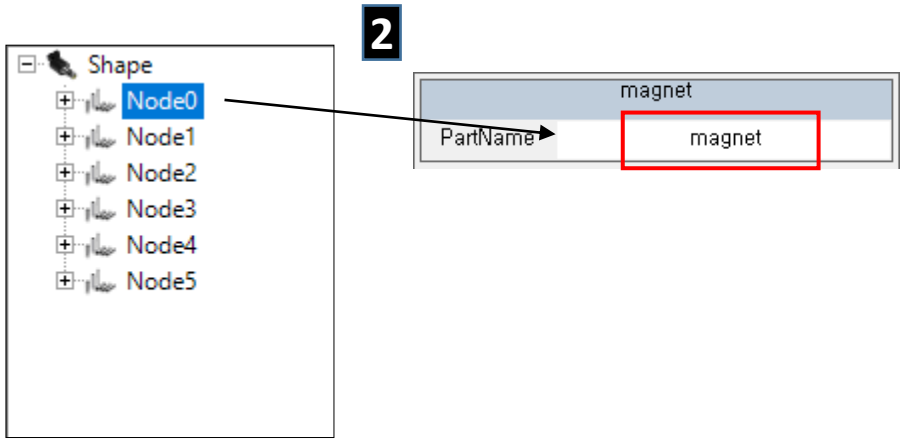




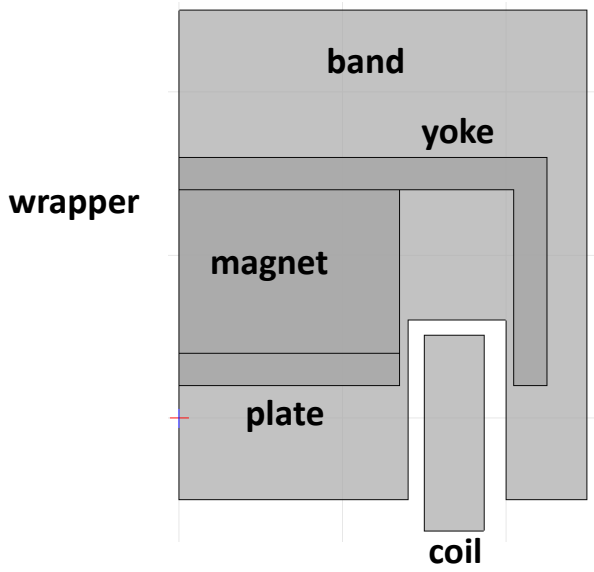


Part 명칭 변경

1. **Part 선택**
   - Tree View > 파트 선택
2. **Part 명 변경**
   - 하단 속성 창에서 Part 명 변경함



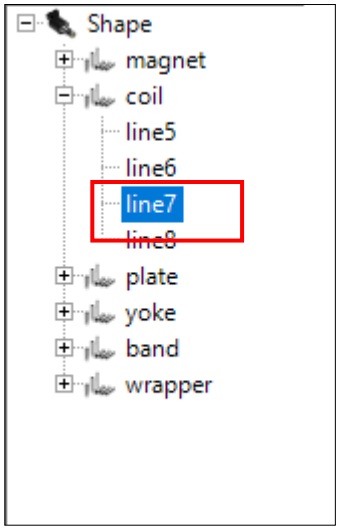
수정 전	수정 후
Node0	**magnet**
Node1	**coil**
Node2	**plate**
Node3	**yoke**
Node4	**band**
Node5	**wrapper**



Coil 형상 변경

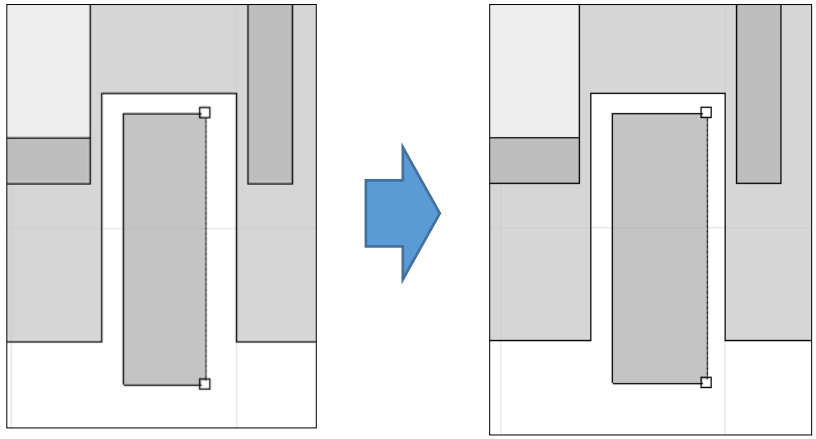
1. **Coil 외경 선택**
   - Tree View > coil 더블클릭 (coil tree 확장)
   - line7 선택
2. **Coil 외경 변경**
   - P1_X : **1.92**
   - P2_X : **1.92**

1



2

Line 7	
P1_X[mm]	1.92
P1_Y[mm]	-0.69
P2_X[mm]	1.92
P2_Y[mm]	0.51

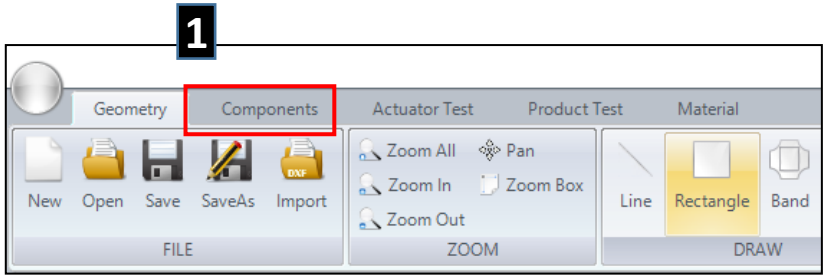


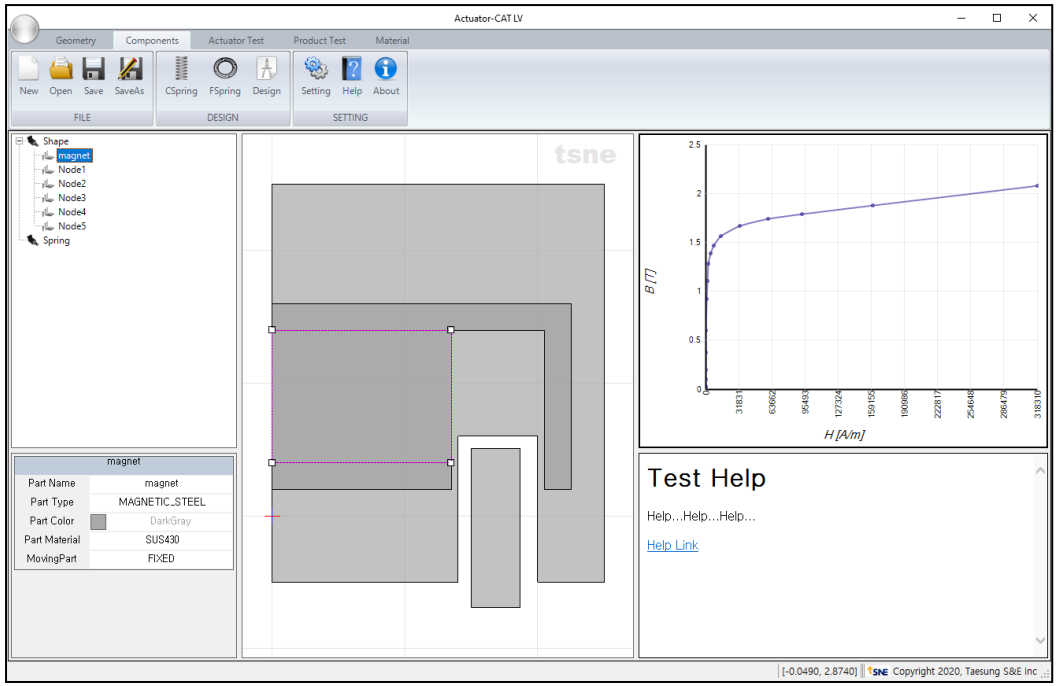
03 부품 설계 (Components Design)

- 단계 설명 : 파트별 설계 및 속성 변경
- 작업 내용 : 코일, 스프링 설계, 재질 변경

부품 설계 이동

1. **Components 단계 이동**
   - Toolbar > Components Tab 선택

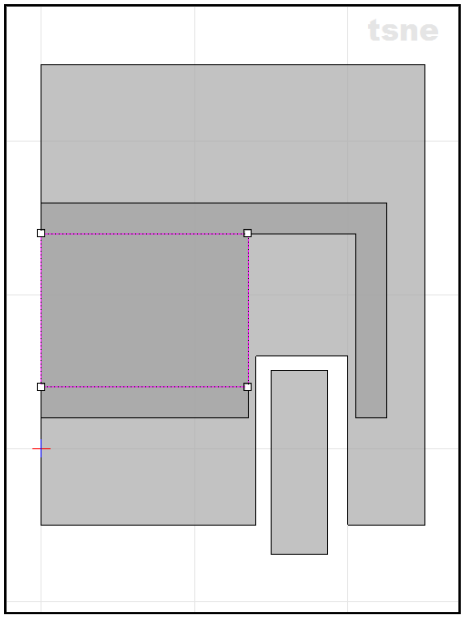




Magnet 설정

1. **Magnet 선택**
   - Tree View > magnet 선택

2. **속성 변경**
   - Part Type : MAGNETIC_STEEL → **MAGNET**
   - Moving Part : FIXED → **MOVING**



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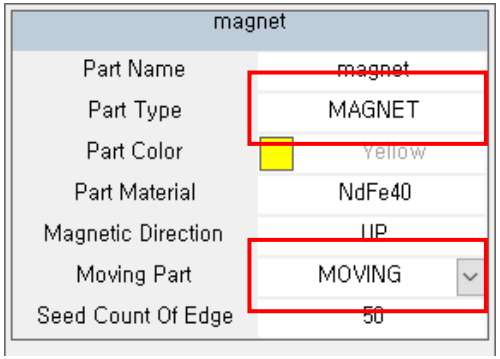
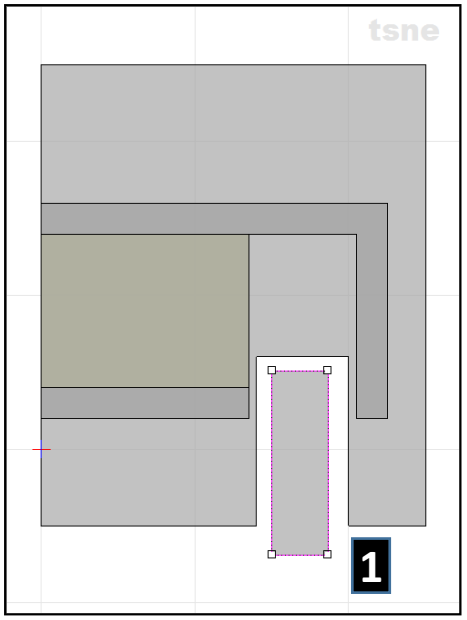


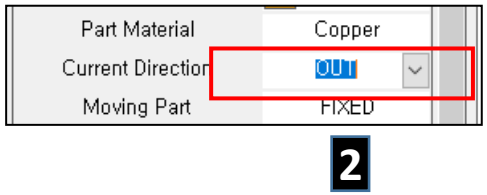
2

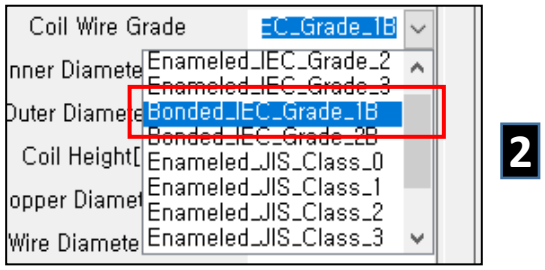
Coil 설정

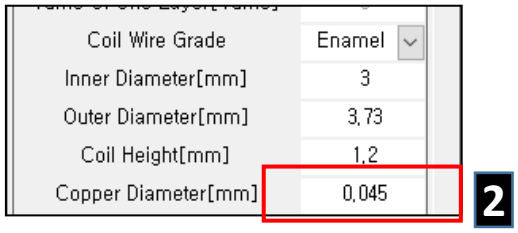
1. **Coil 선택**
   - Tree View > coil 선택

2. **속성 변경**
   - Part Type : MAGNETIC_STEEL → **COIL**
   - Current Direction : **OUT** 선택
   - Coil Wire Grade : **Bonded_IEC_Grade_1B** 선택
   - Copper Diameter : 0.35 mm → **0.045**



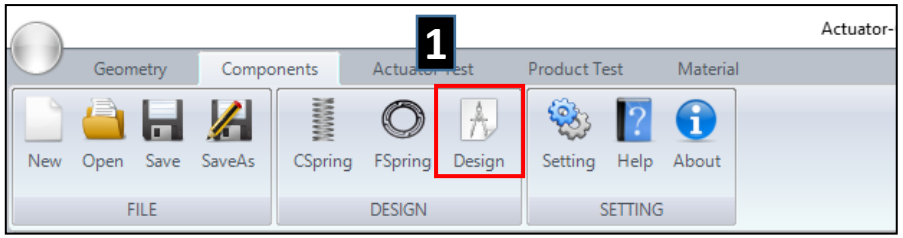






Coil 설계

1. **Coil 설계**
   - Toolbar > Design 클릭
2. **설계 결과 확인**



coil	
Part Name	coil
Part Type	COIL
Part Color	Orange
Part Material	Copper
Current Direction	OUT
Moving Part	FIXED
Turns[Turns]	617
Coil Resistance[Ω]	15,21
Coil Layers[Layers]	0
Turns Of One Layer[Turns]	0
Coil Wire Grade	Bonded_IEC_
Inner Diameter[mm]	3
Outer Diameter[mm]	3,37
Coil Height[mm]	1,2
Copper Diameter[mm]	0,045
Wire Diameter[mm]	0,049533604
Coil Temperature[℃]	20
Horizontal Coefficient	0,9
Vertical Coefficient	0,98
Resistance Coefficient	1

coil	
Part Name	coil
Part Type	COIL
Part Color	Orange
Part Material	Copper
Current Direction	OUT
Moving Part	FIXED
Seed Count Of Edge	50
Turns[Turns]	192
Coil Resistance[Ω]	22,172
Coil Layers[Layers]	8
Turns Of One Layer	24
Coil Wire Grade	Bonded_IEC_Grad
Inner Diameter[mm]	3
Outer Diameter[mm]	3,84
Coil Height[mm]	1,2
Copper Diameter[mm]	0,045
Wire Diameter[mm]	0,0495
Coil Temperature[℃]	20
Horizontal Coefficient	0,9
Vertical Coefficient	0,98
Resistance Coefficient	1

2

연자성체 설정

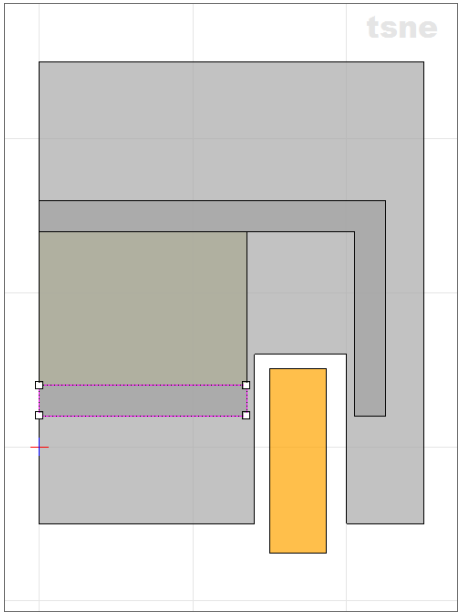
1. **Plate 선택**
   - Tree View > plate 선택

2. **속성 변경**
   - Moving Part : FIXED → **MOVING**

3. **Yoke 선택**
   - Tree View > yoke 선택

4. **속성 변경**
   - Moving Part : FIXED → **MOVING**

1



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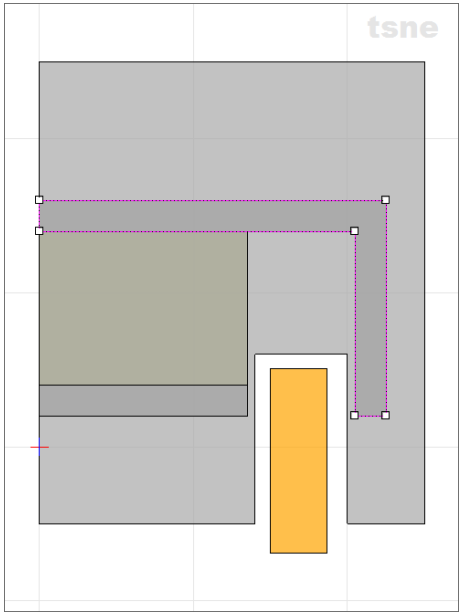


2

plate	
Part Name	plate
Part Type	MAGNETIC_STEEL
Part Color	DarkGray
Part Material	SUS430
Moving Part	MOVING
Seed Count Of Edge	50

4

yoke	
Part Name	yoke
Part Type	MAGNETIC_STEEL
Part Color	DarkGray
Part Material	SUS430
Moving Part	MOVING
Seed Count Of Edge	50

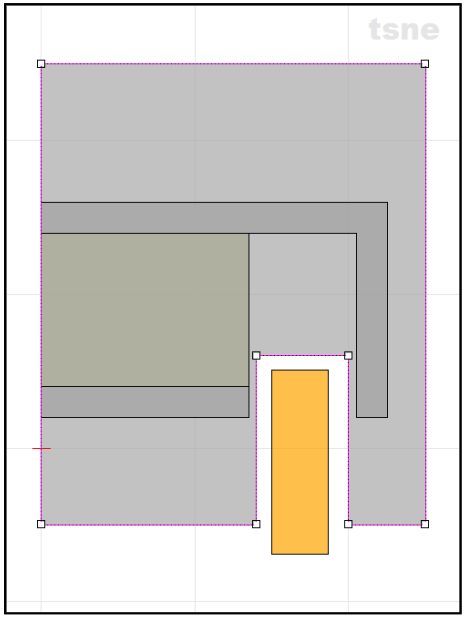
해석 형상 설정

1. **Band 선택 (동작 영역)**
   - Tree View > band 선택

2. **속성 변경**
   - Part Type : MAGNETIC_STEEL → **BAND**

3. **Wrapper 선택 (구동부 묶음)**
   - Tree View > wrapper 선택

4. **속성 변경**
   - Part Type : MAGNETIC_STEEL → **WRAPPER**



1

band

Part Name	band
Part Type	BAND
Part Color	LightPink
Seed Count Of Edge	50

2

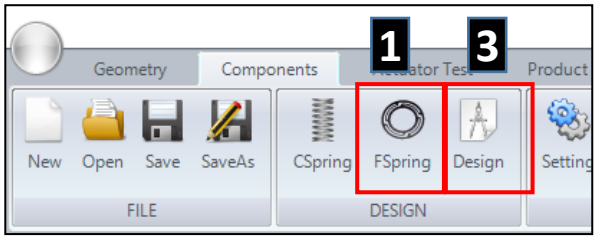
wrapper

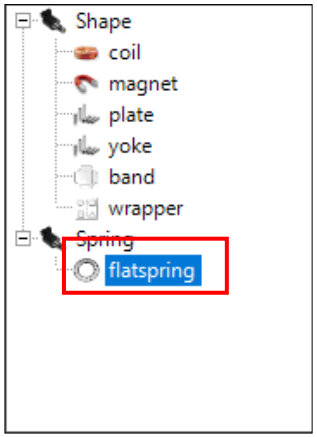
Part Name	wrapper
Part Type	WRAPPER
Part Color	White
Seed Count Of Edge	50

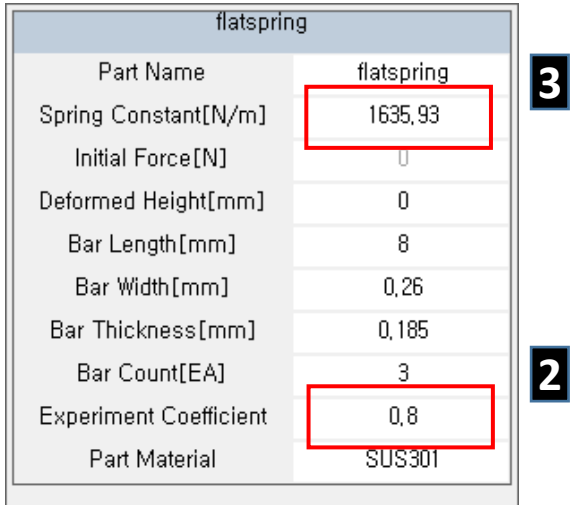
4

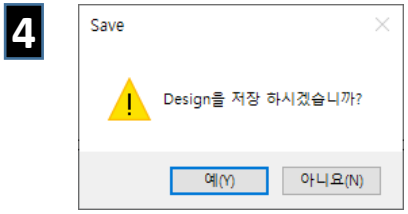
Spring 설계

1. **Flat Spring 추가**
   - Toolbar > FSpring 클릭
2. **사양 변경**
   - flatspring 선택
   - Experiment Coefficient : **0.8**
3. **Toolbar > Design 버튼 클릭**
4. **Toolbar > Save 버튼 클릭**







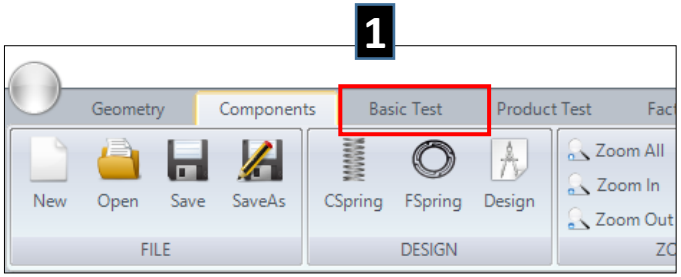


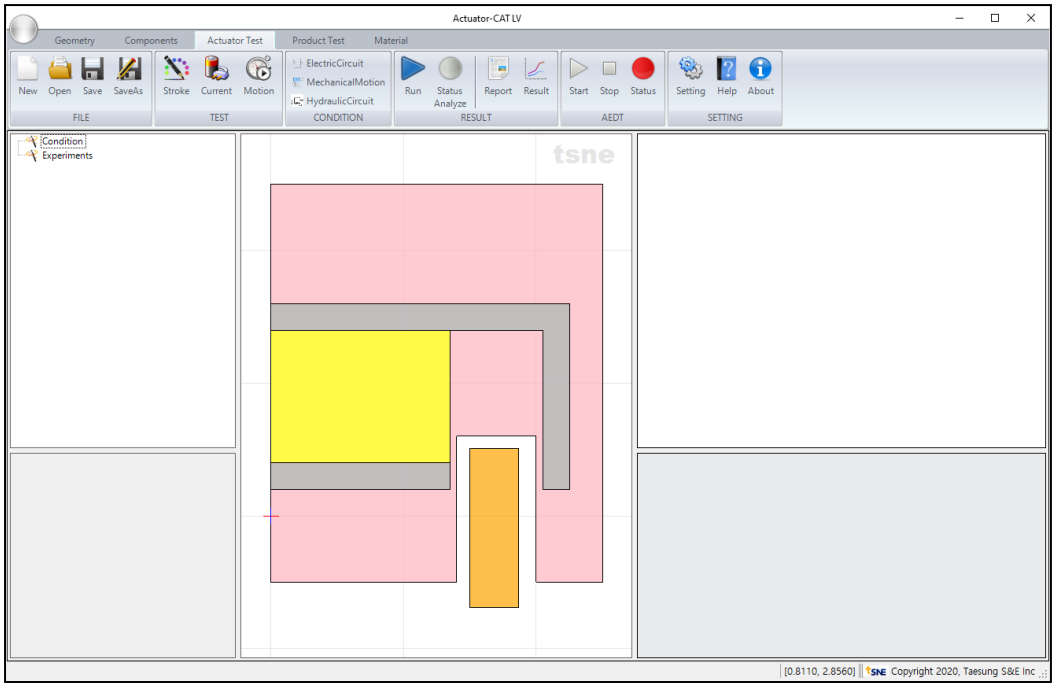
04 자기력 해석

- 단계 설명 : 성능검증 2차원 해석
- 작업 내용 : 변위-자기력 해석, 전류-자기력 해석

Basic Test 이동

1. **Basic Test 단계 이동**
   - Toolbar > Basic Test Tab 선택

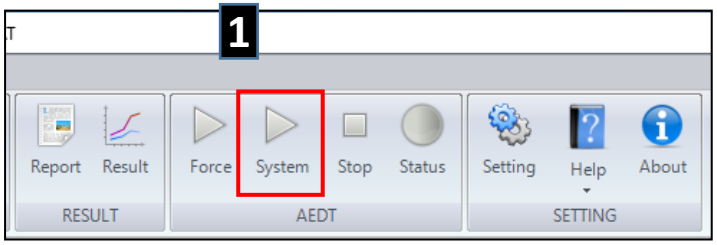


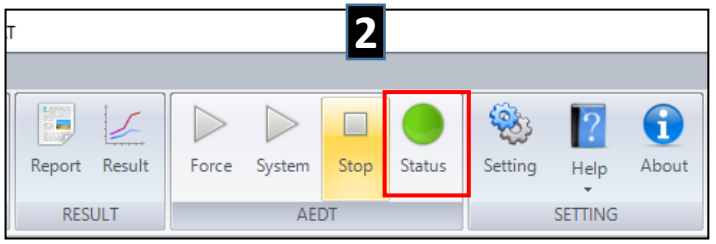


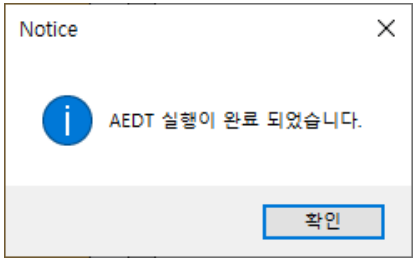
Maxwell Solver 실행

1. **Solver 실행**
   - Toolbar > AEDT > System 클릭

2. **실행 확인 (약 2분 소요)**
   - AEDT 실행 완료 메시지 창 확인







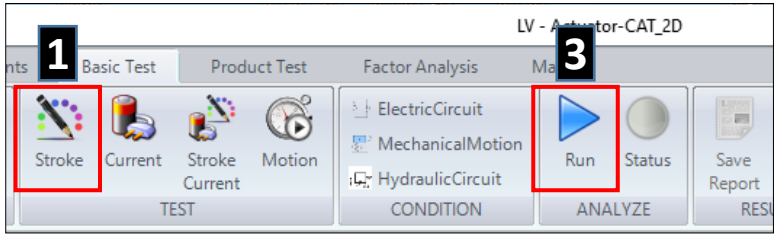
변위별 자기력 해석

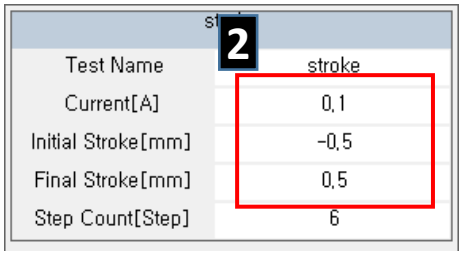
1. **Stroke 해석 추가**
   - Toolbar > Stroke 클릭
   - Tree View > stroke 선택

2. **해석조건 변경**
   - Current : **0.1**
   - Initial Stroke : **-0.5**
   - Final Stroke : **0.5**

3. **Stroke 해석**
   - Toolbar > Run 클릭 (약 2분 소요)

4. **Stroke 해석 완료**
   - 해석 완료 메시지 창 확인





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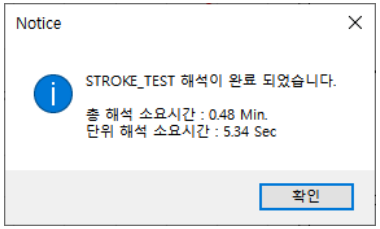
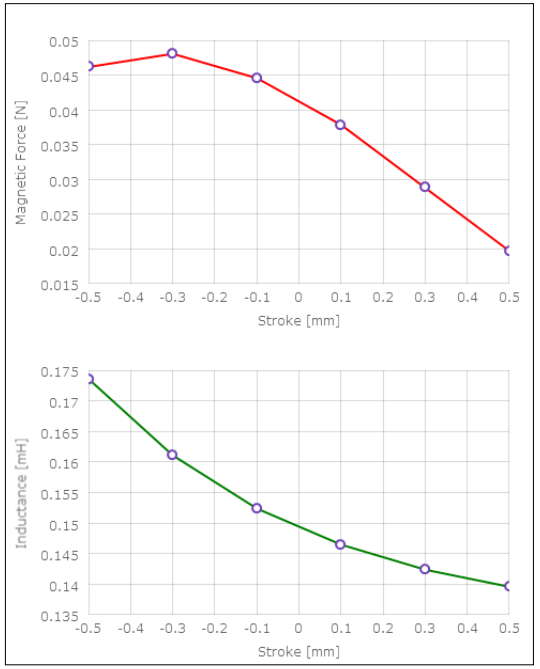




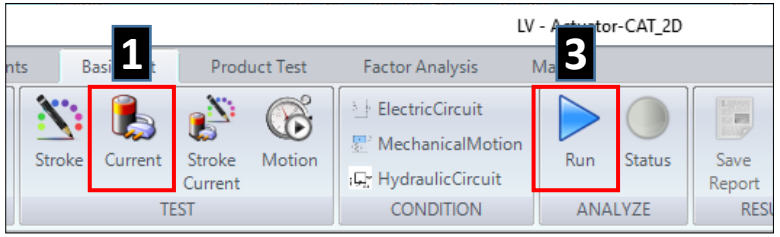
전류별 자기력 해석

1. **Current 해석 추가**
   - Toolbar > Current 클릭
   - Tree View > current 선택

2. **해석조건 변경**
   - Final Current : **0.1**

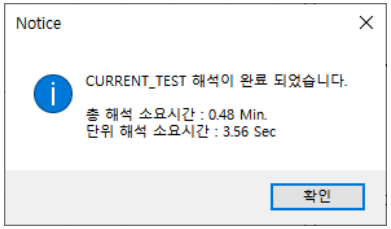
3. **Current 해석**
   - Toolbar > Run 클릭 (약 2분 소요)

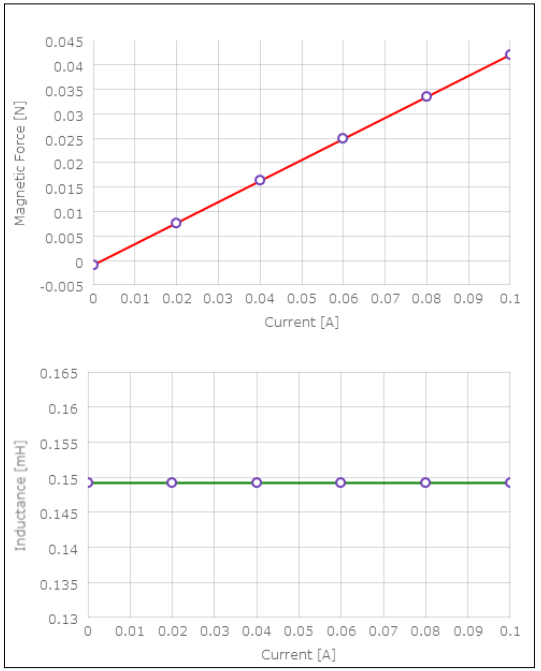
4. **Current 해석 완료**
   - 해석 완료 메시지 창 확인



current	
Test Name	current
Stroke[mm]	0
Initial Current[A]	0
Final Current[A] 2	0.1
Step Count[Step]	6

4





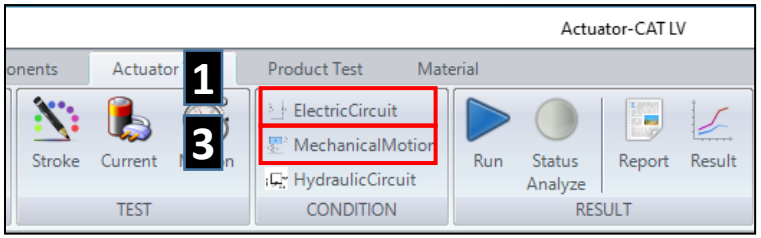
05 진동자 거동 해석

- 단계 설명 : 성능검증 시스템 해석
- 작업 내용 : 진동자 공진 거동해석

tSNE

구동자 거동 해석

1. **전기회로 추가**
   - Toolbar > ElectricCircuit 클릭
2. **전기회로 속성 변경**
   - Circuit Type : **CURRENT_CONTROL** 선택
   - Signal Type : **SIN** 선택
   - Current : **0.1**
   - Frequency : **175**
3. **기계운동 추가**
   - Toolbar > MechanicalMotion 클릭
4. **기계운동 속성 변경**
   - Mass : **1.32**
   - First Spring Name : **flatspring** 선택
   - Upper Stroke Limit : **0.5**
   - Lower Stroke Limit : **-0.5**



electriccircuit

Condition Name	electriccircuit
Circuit Type	CURRENT_CONTROL
Signal Type	SIN
Current[A]	0.1
Period[ms]	5.71
Frequency[Hz]	175
Offset	0
Time Step[ms]	0.143

2

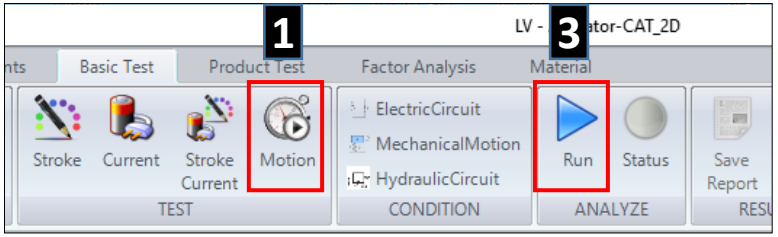
mechanicalmotion

Condition Name	mechanicalmoti
Mass[g]	1.32
Gravity Condition	GRAVITY_OFF
Damping[N·s/m]	0.1
First Spring	flatspring
Second Spring	
Upper Stroke Limit[mm]	0.5
Lower Stroke Limit[mm]	-0.5
Magnetic Force Ratio	0.95
Friction Coefficient	0.2
Side Force Ratio	0

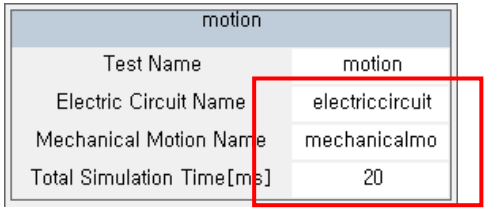
4

구동자 거동 해석

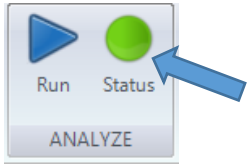
1. **Motion 해석 추가**
   - Toolbar > Motion 클릭



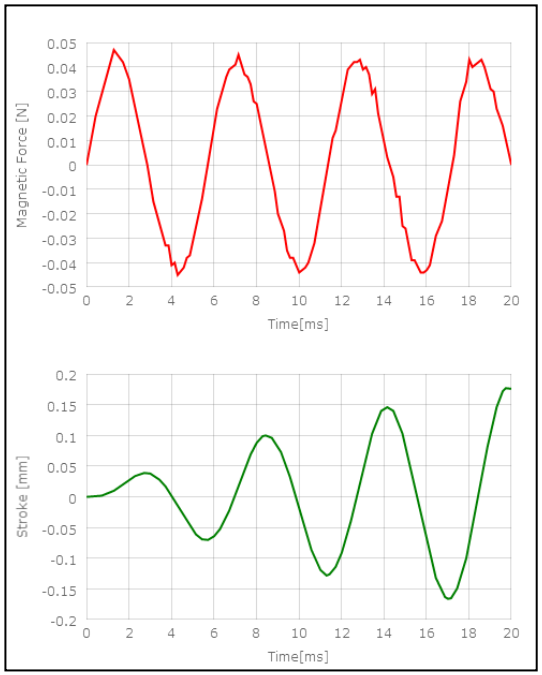
2. **해석조건 선택 (속성 창)**
   - Electric Circuit Name > **electriccircuit** 선택
   - Mechanical Motion Name > **mechanicalmotion** 선택
   - Total Simulation Time : **20**



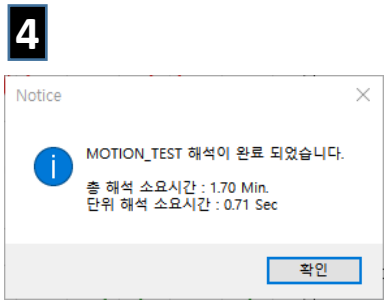
3. **거동 해석**
   - Toolbar > Run 클릭 (약 3분 소요)



해석 중 표시



4. **Motion 해석 완료**
   - 해석 완료 메시지 창 확인



감사합니다.

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