Mini mmi

2009008863 김동하
2009009383 한영규

MINI mmi

(man machine interface)

Concept

기준을 만족하는

가장 작고 편한 차

> 의자가 편해야..

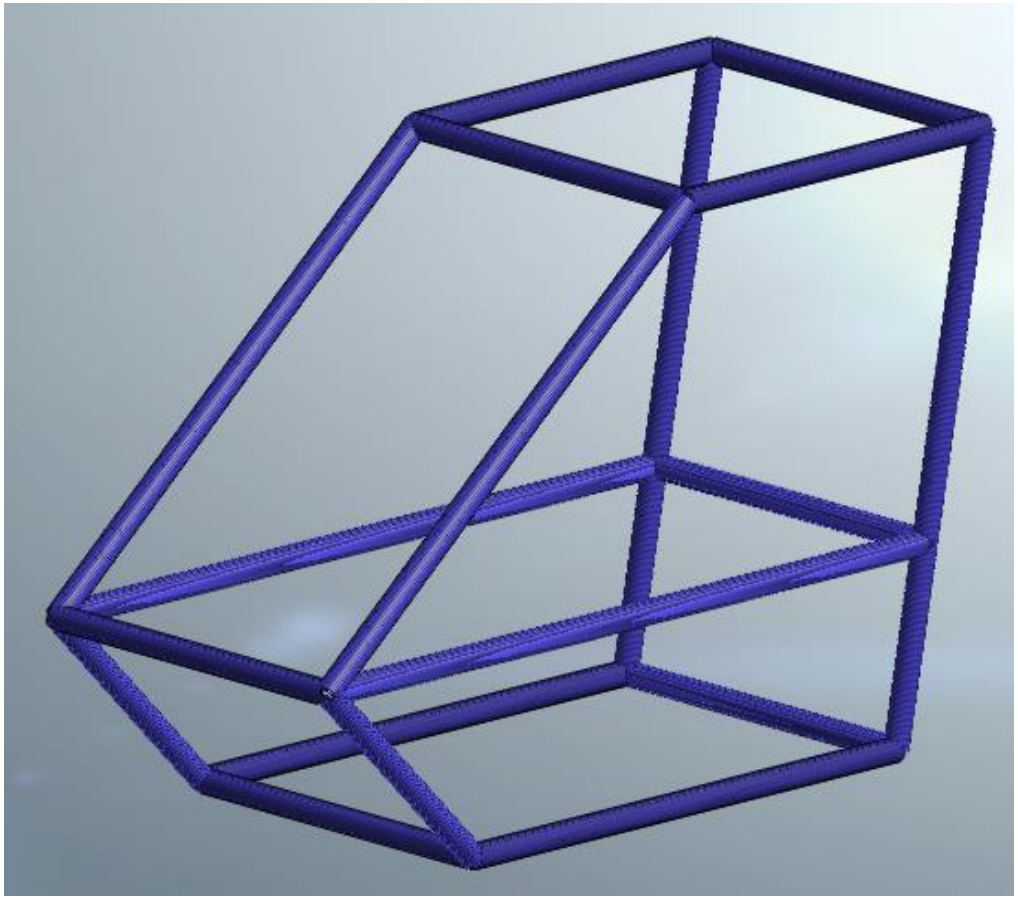
설계 목표

- 진동수 25Hz를 넘는 연료포함 230Kg의 차량
- 사람무게 : 70kg
- 엔진무게 : 100kg
- 연료무게 3kg

>>55~57kg의 baja차량 설계

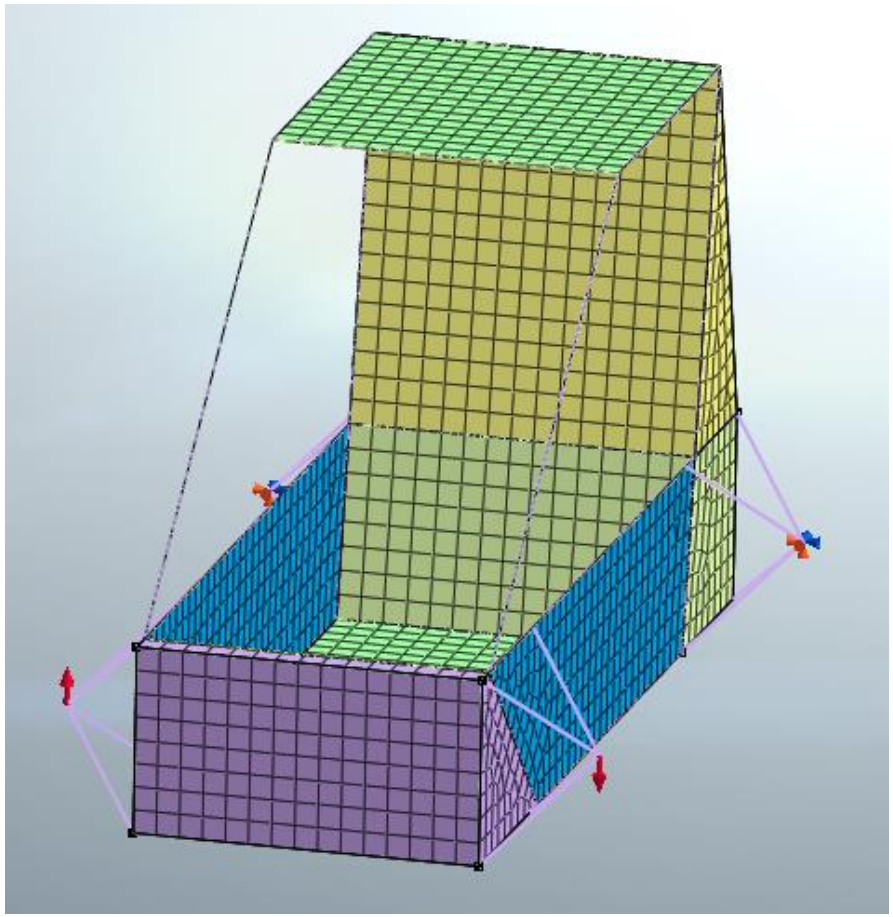
설계 진행

- ROLL CAGE 설계



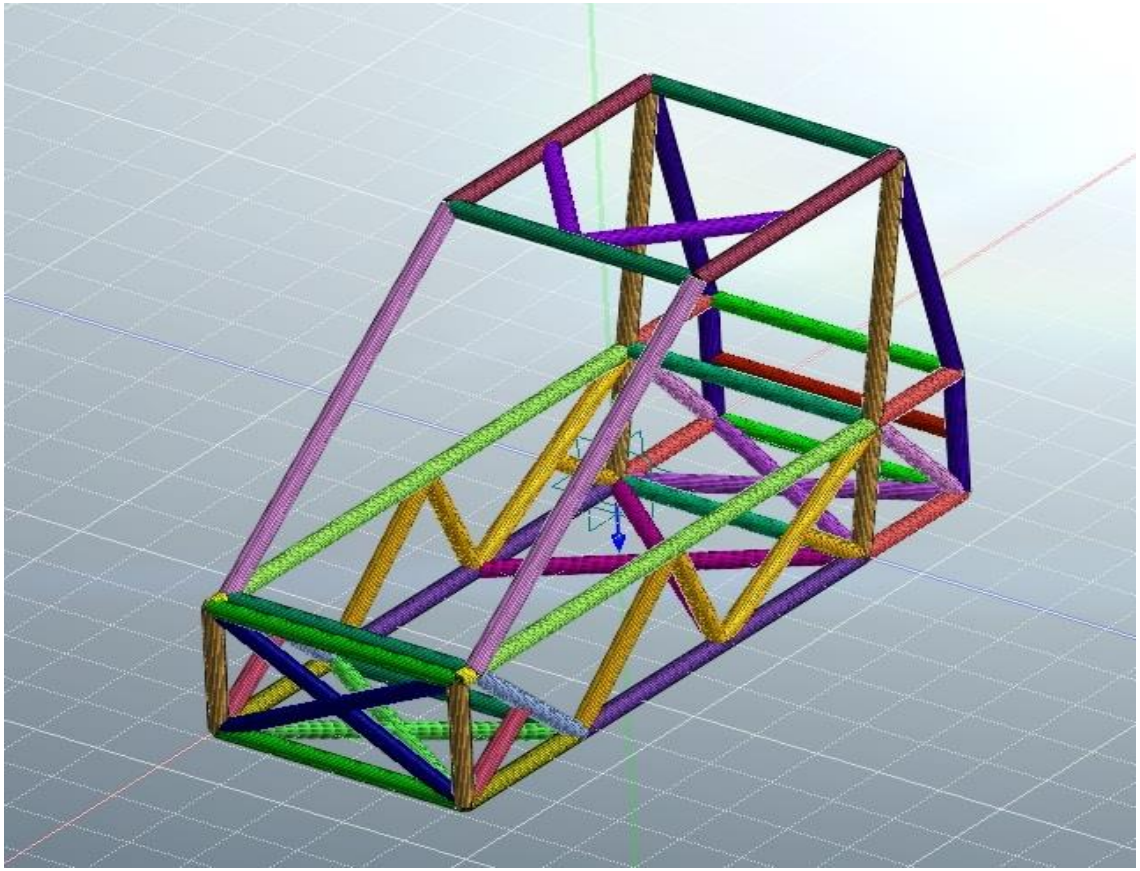
설계 진행

- 쉘요소 생성 후 위상최적화 실행

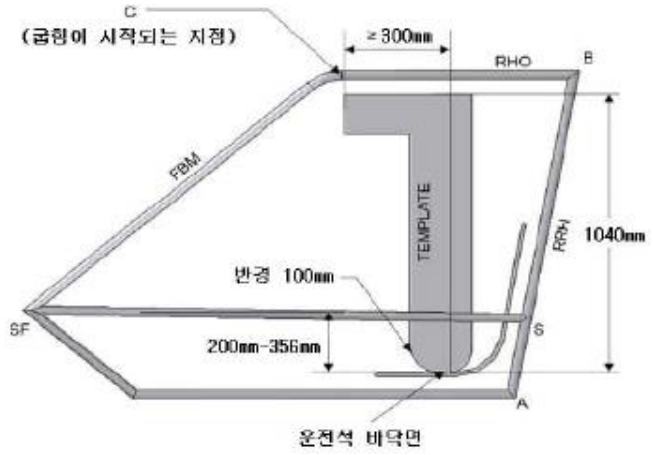


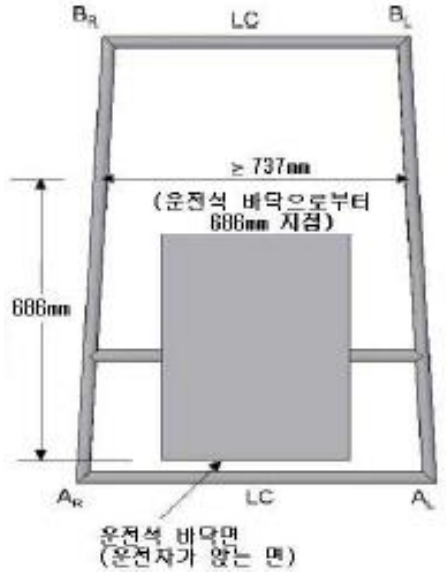
설계 진행

- 보강재 생성 및 치수 최적화 실행



롤케이지 설계





드라이버의 헬멧과 RHO의 간격
152MM >> 높이 1200MM

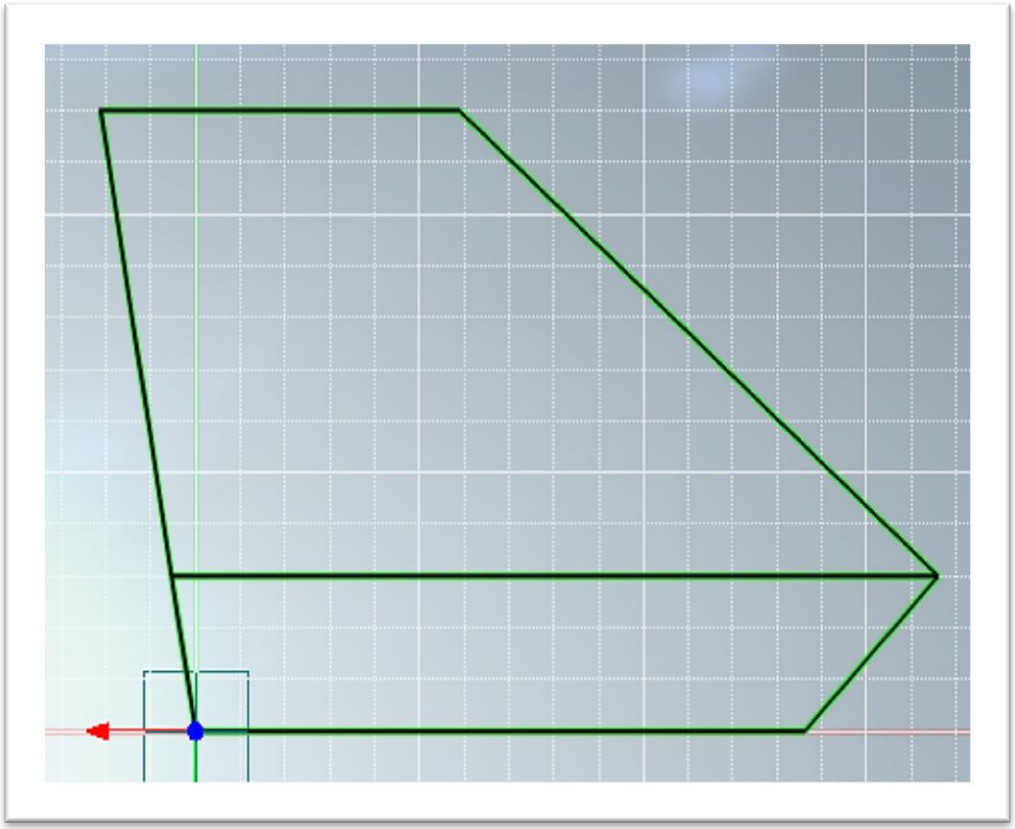
바닥부터 686MM인 지점의 폭
737MM >> 차체의 폭 737MM

-2012 KSAE BAJA규정집

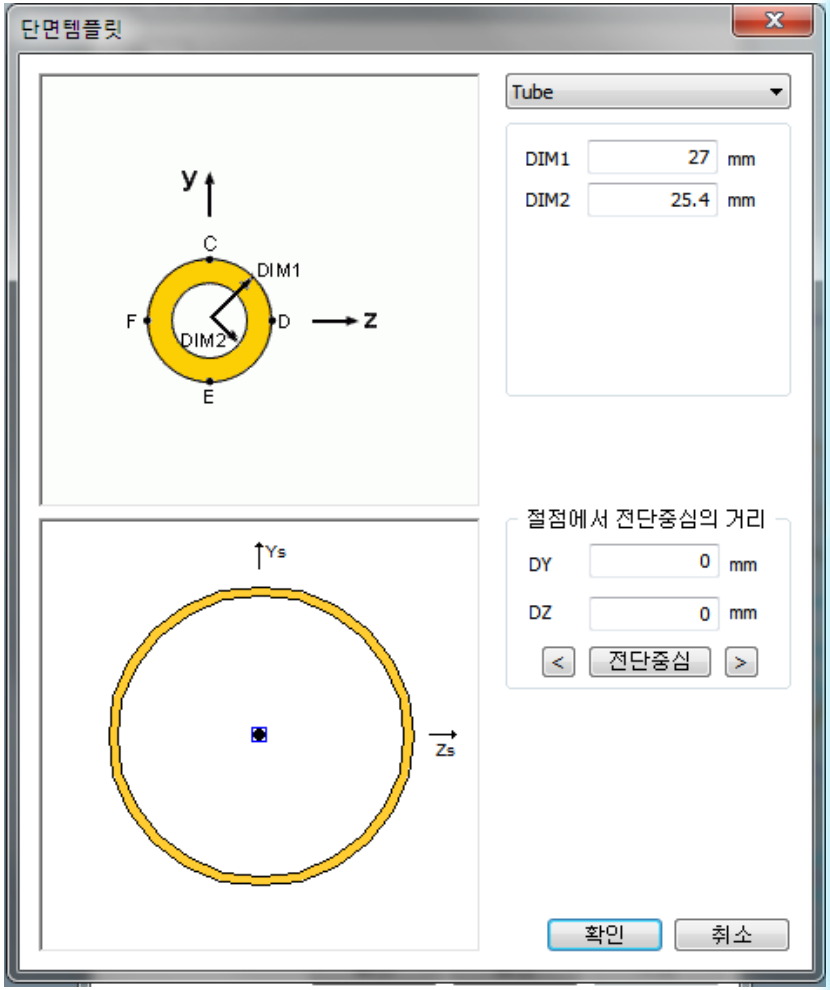
임의 지정

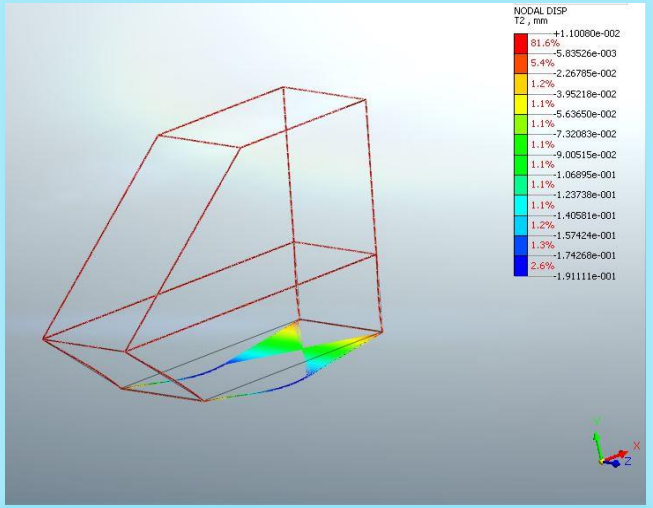
- FBM의 각도 >>40DEG
- SF의 각도 >> 45DEG
- RPH의 각도
  >> 80DEG(편한 의자의 각도)
- RHO 800MM

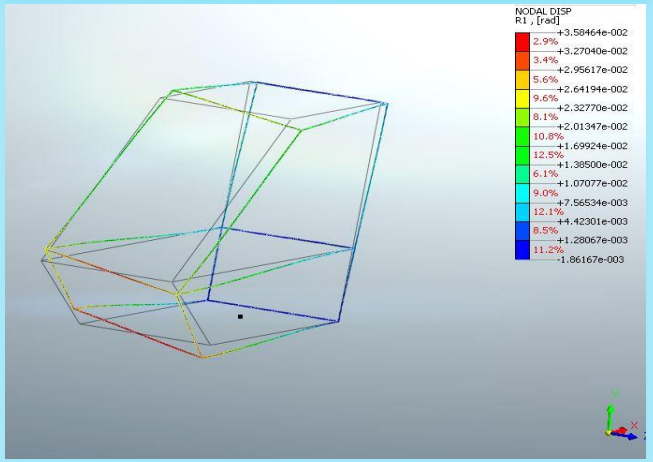
롤케이지 설계 단면



Roll cage 구성 beam 단면형상 및 굽힘, 비틀림 해석 실행







굽힘, 비틀림 해석 실행 결과

300MM

- 굽힘 1.10e-2mm , 비틀림 3.97e-2rad

350MM

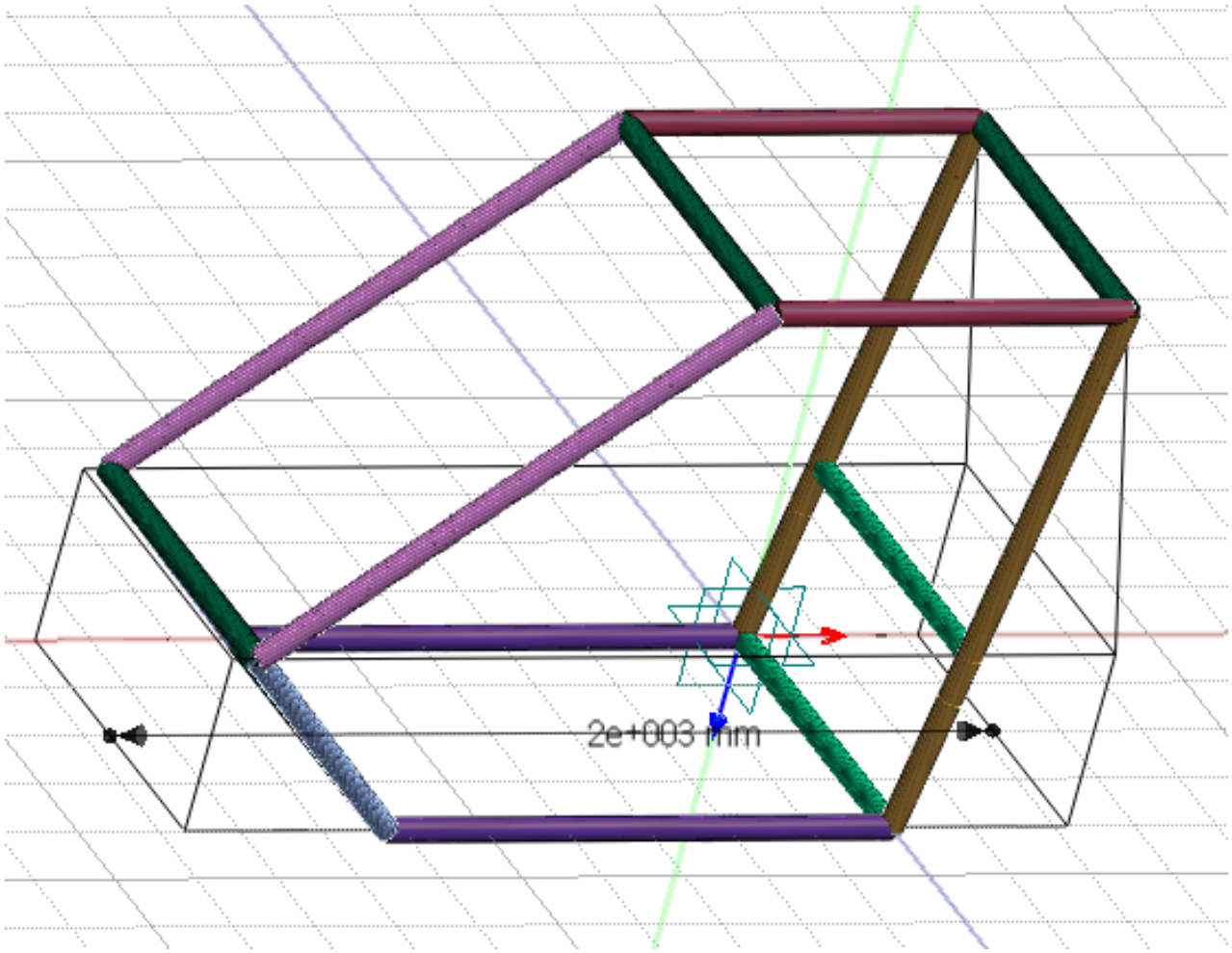
- 굽힘 2.23e-1mm , 비틀림 3.78e-2rad

400MM

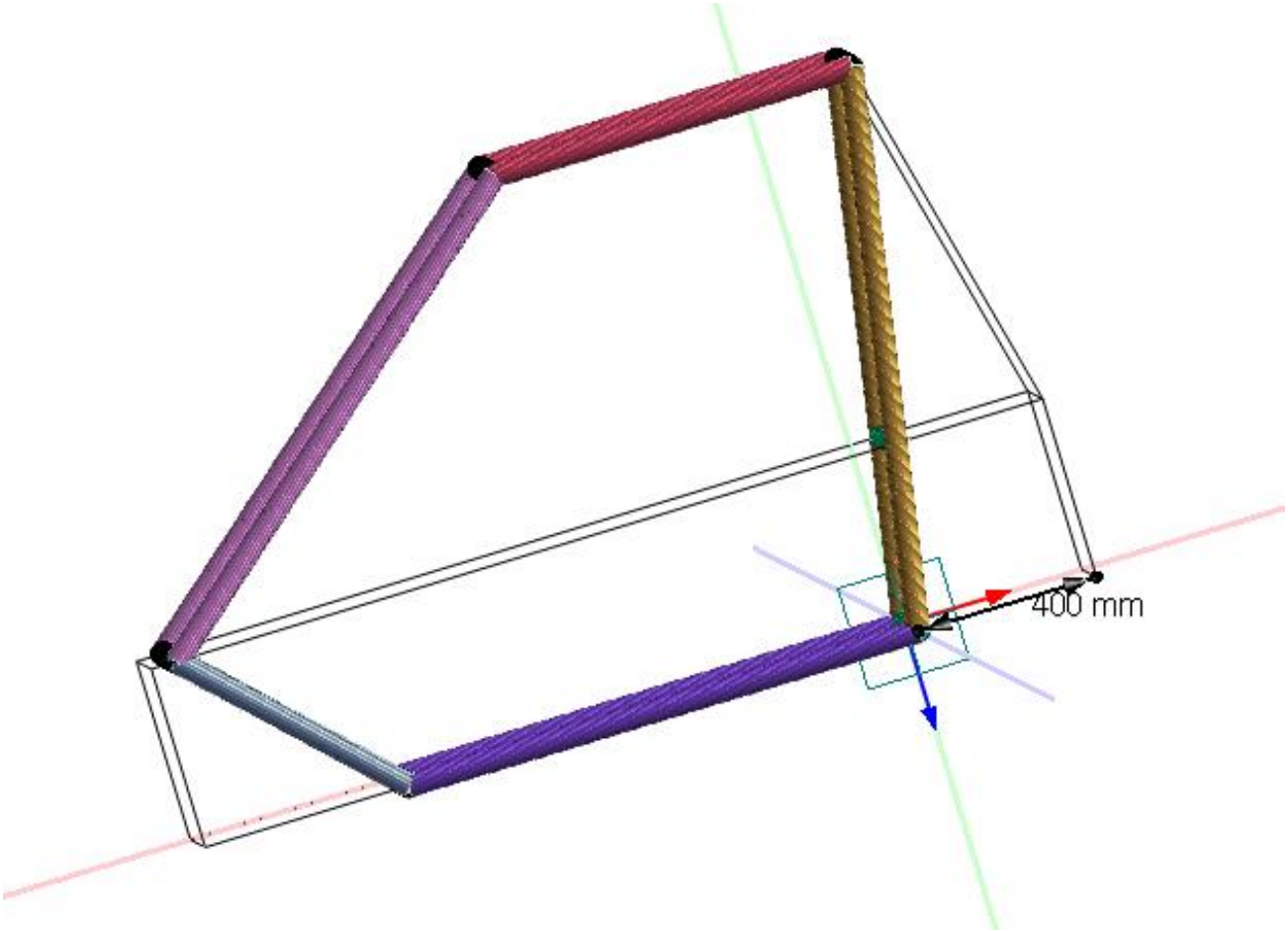
- 굽힘 1.10e-1mm , 비틀림 3.58e-2rad

선택 400mm

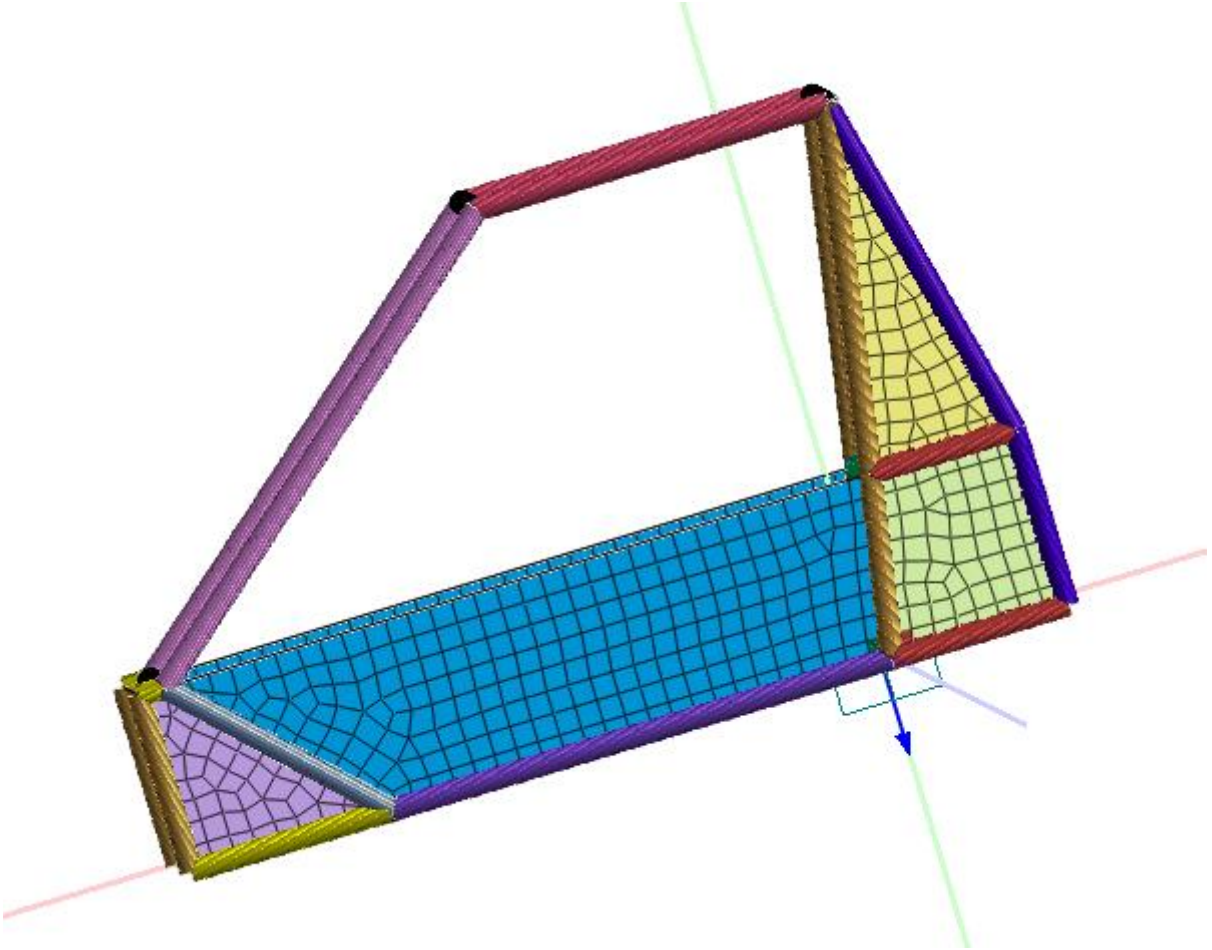
보강재 설계과정



보강재 설계과정

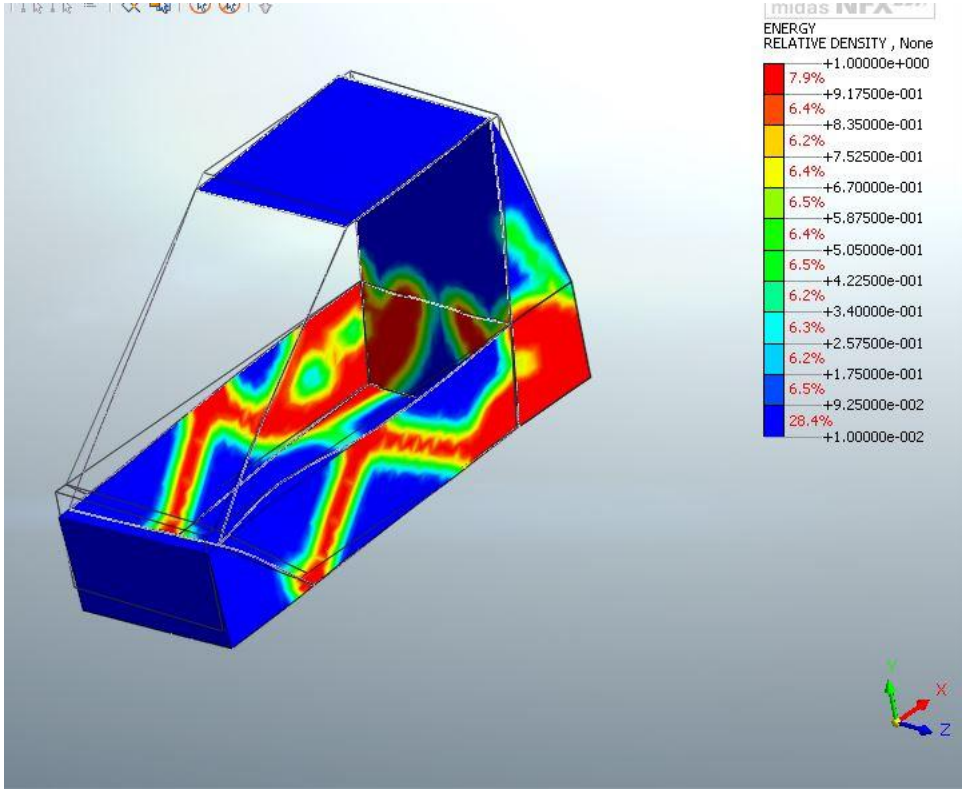


보강재 설계과정



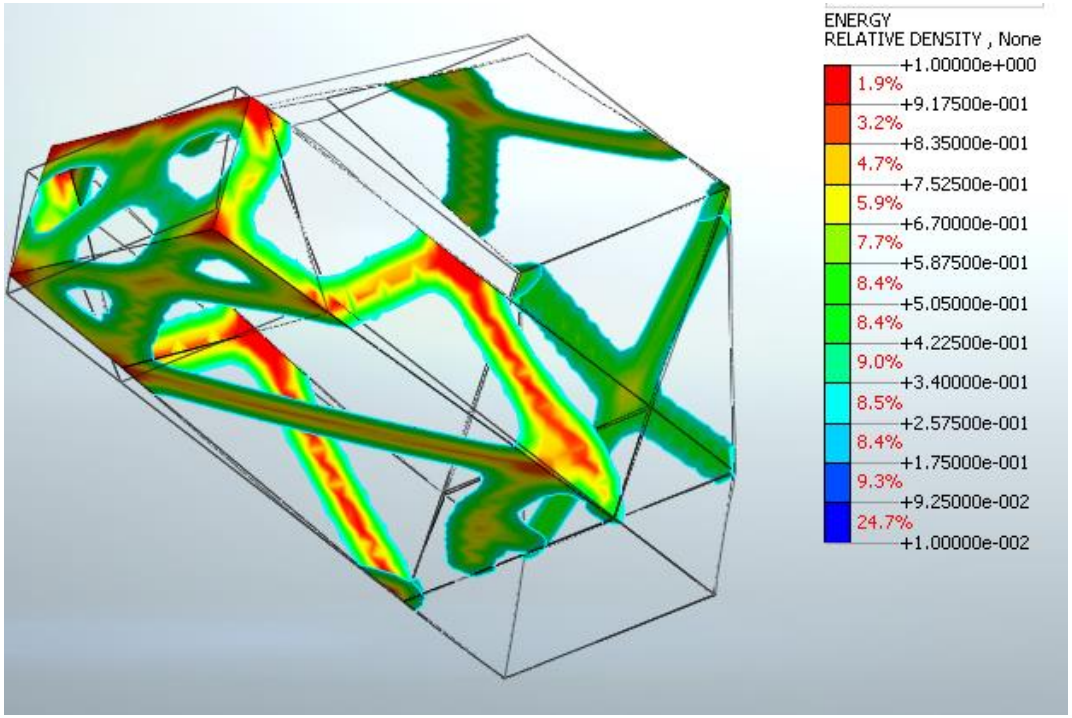
보강재 설계과정

- 굽힘 위상최적화 결과



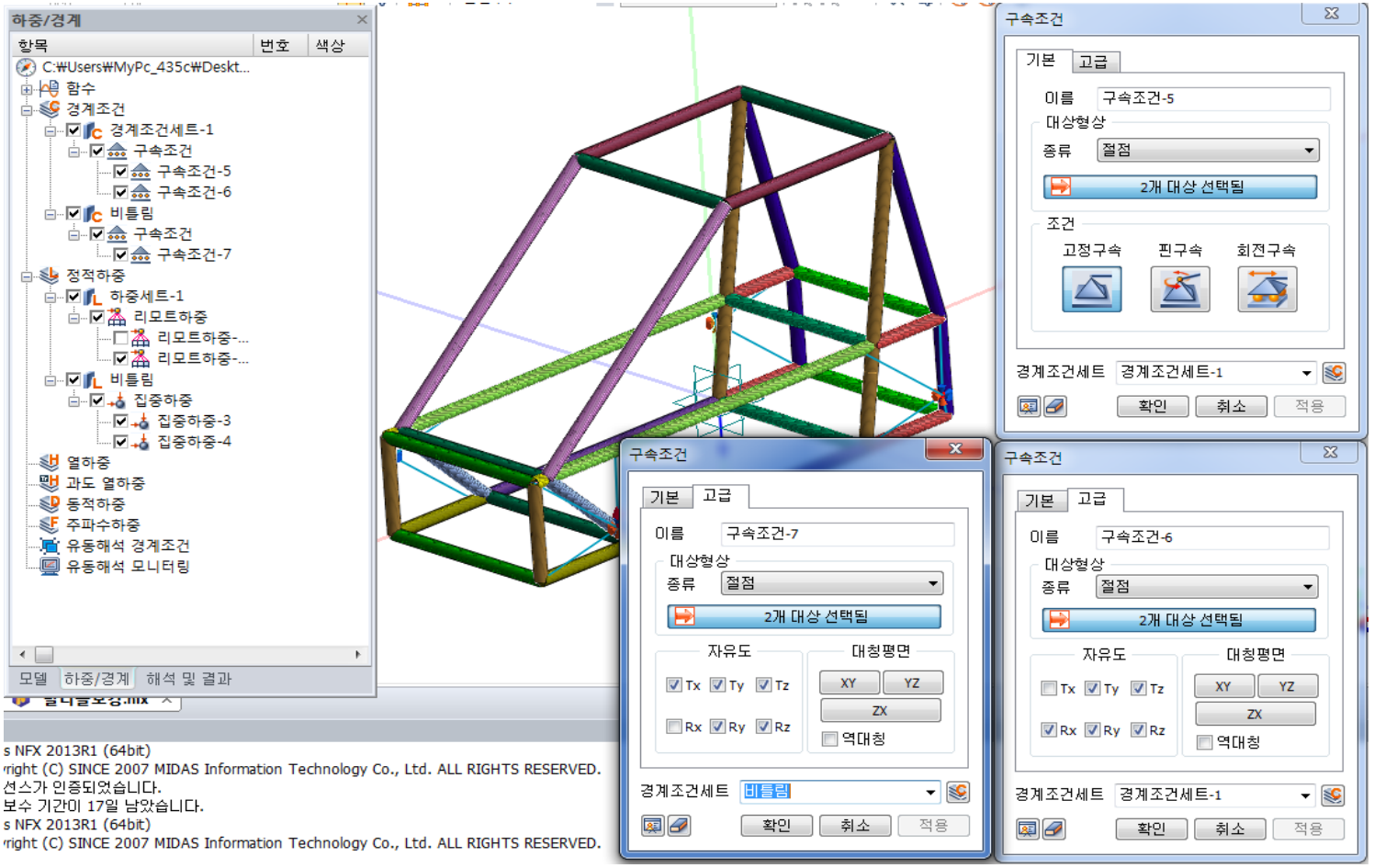
보강재 설계과정

- 비틀림 위상최적화 결과



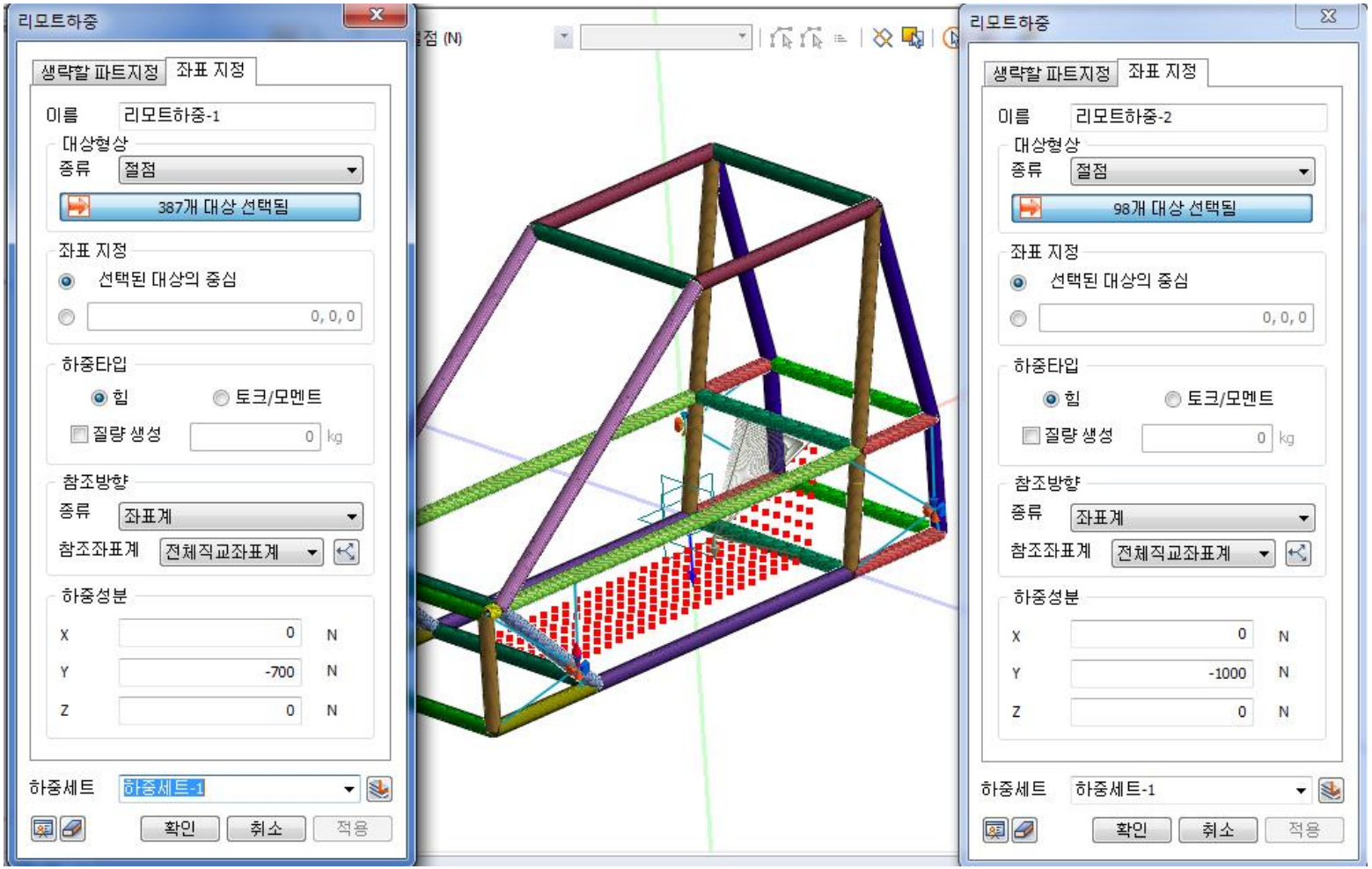
멀티플로딩

- 구속조건 및 구속조건세트 설정



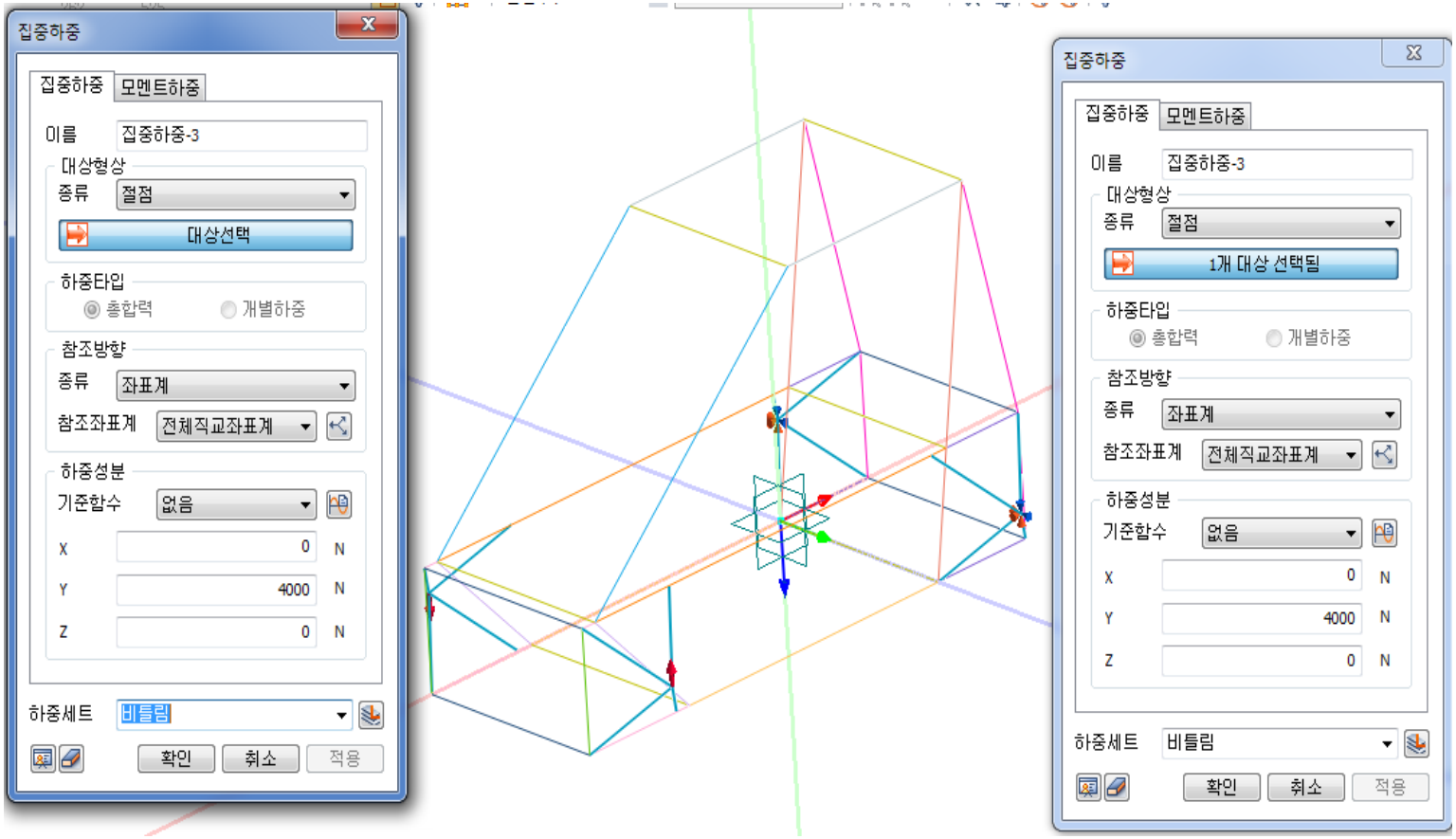
멀티플로딩

- 굽힘 하중조건 설정
  - 사람 700N, 엔진 1000N이라 가정

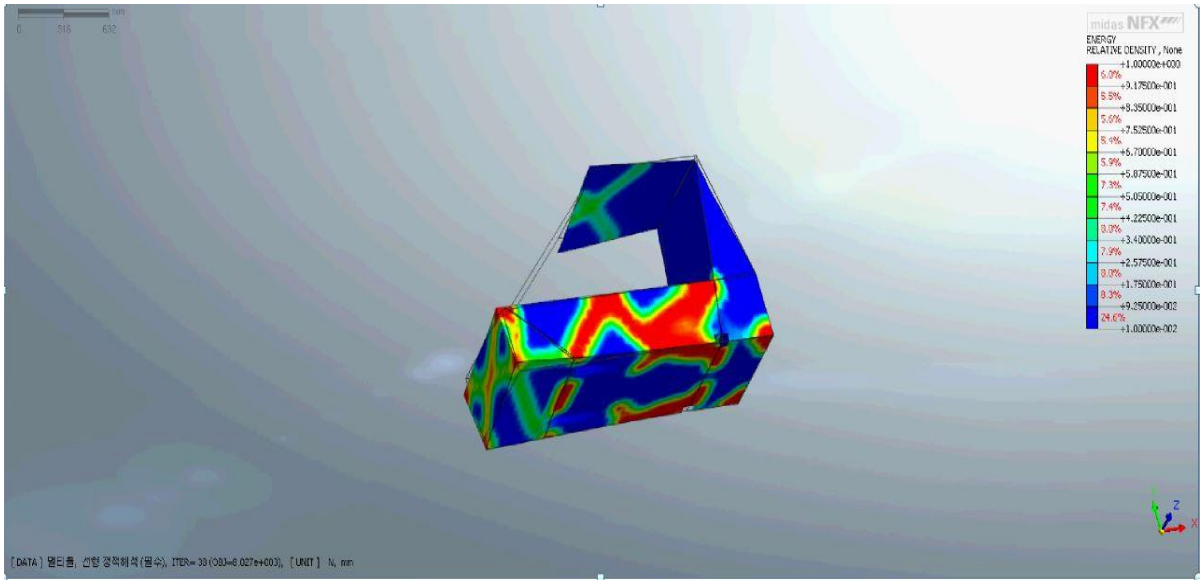


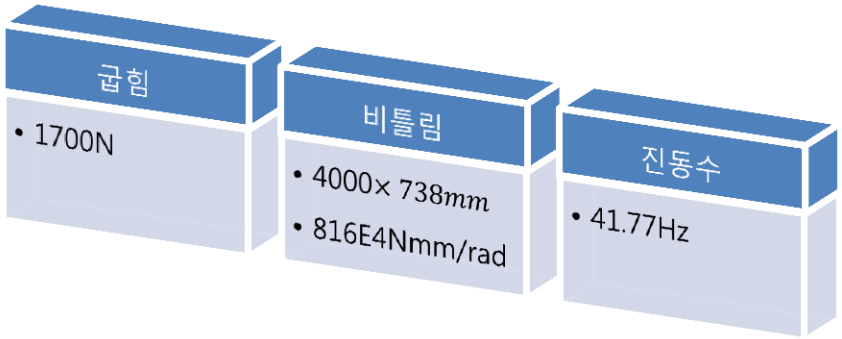
멀티플로딩

- 비틀림 하중조건 설정

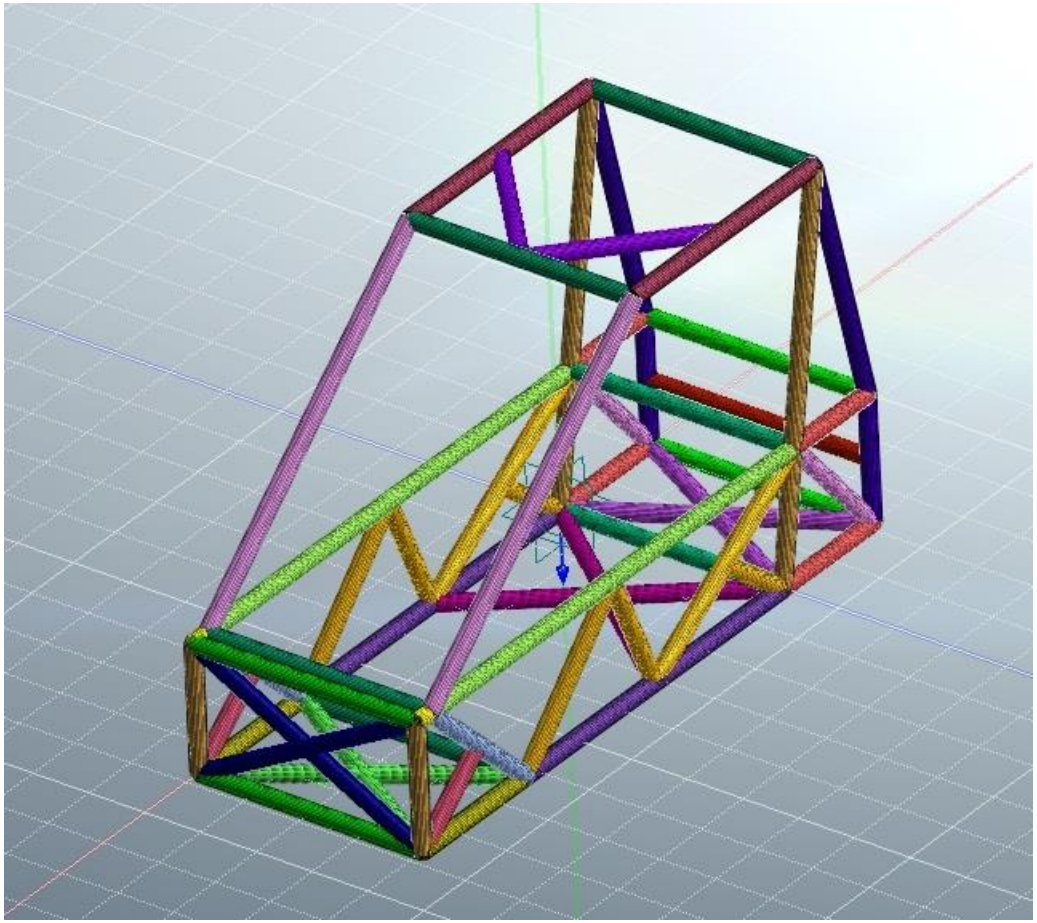


멀티플로딩 결과

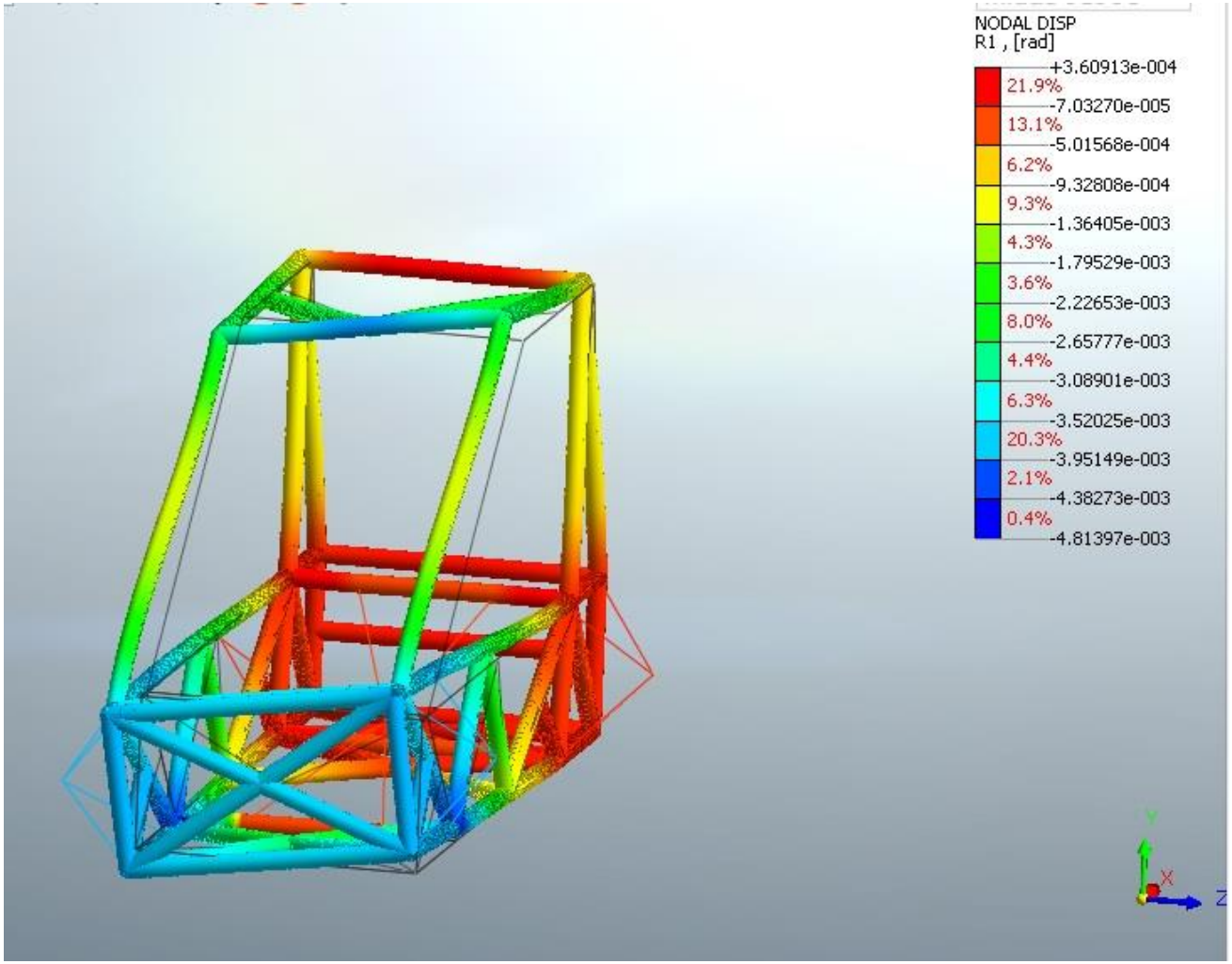

midas NFX
ENERGY
RELATIVE DENSITY , None
+1.00000e+000
6.0%
+9.17500e-001
5.5%
+8.35000e-001
5.6%
+7.52500e-001
5.4%
+6.70000e-001
5.9%
+5.87500e-001
7.3%
+5.05000e-001
7.4%
+4.22500e-001
8.0%
+3.40000e-001
7.9%
+2.57500e-001
8.0%
+1.75000e-001
8.3%
+9.25000e-002
24.6%
+1.00000e-002


굽힘
• 1700N
비틀림
• 4000× 738mm
• 816E4Nmm/rad
진동수
• 41.77Hz

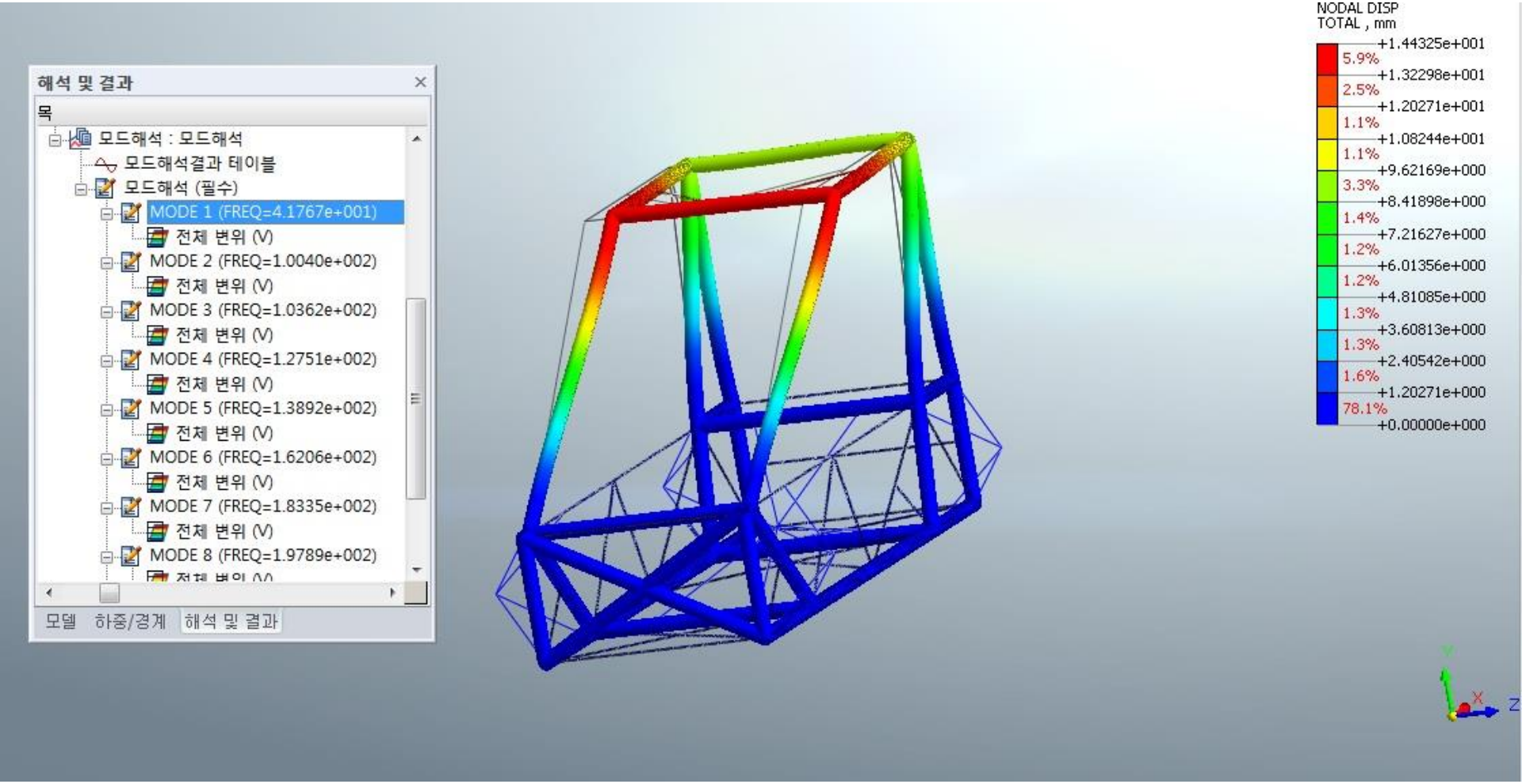
보강재 완성 및 해석결과



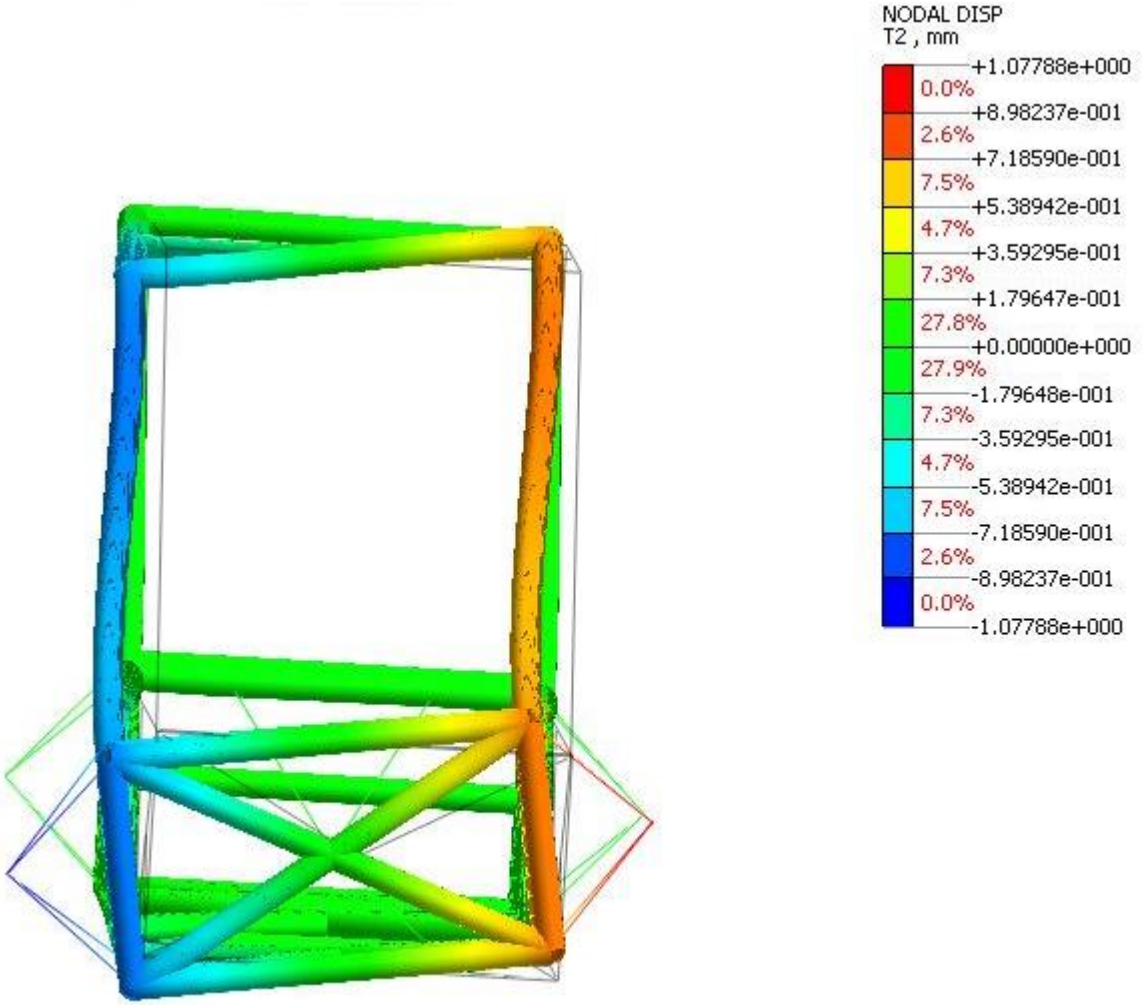
보강재 완성 및 해석결과


NODAL DISP
R1 , [rad]
+3.60913e-004
21.9%
-7.03270e-005
13.1%
-5.01568e-004
6.2%
-9.32808e-004
9.3%
-1.36405e-003
4.3%
-1.79529e-003
3.6%
-2.22653e-003
8.0%
-2.65777e-003
4.4%
-3.08901e-003
6.3%
-3.52025e-003
20.3%
-3.95149e-003
2.1%
-4.38273e-003
0.4%
-4.81397e-003
Y
X
Z

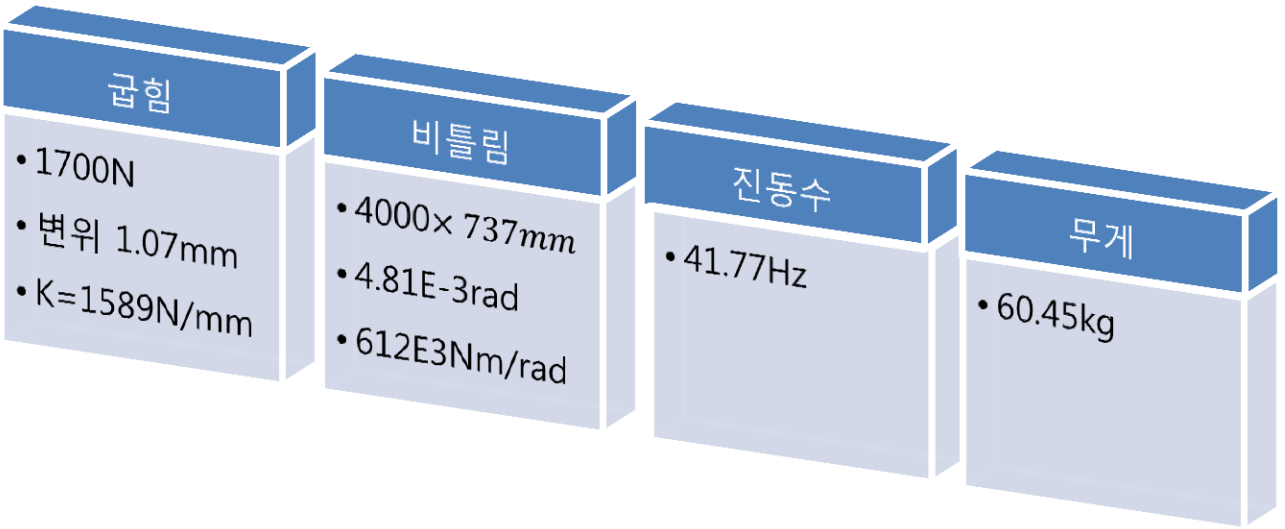
보강재 완성 및 해석결과


해석 및 결과
목
모드해석 : 모드해석
모드해석결과 테이블
모드해석 (필수)
MODE 1 (FREQ=4.1767e+001)
전체 변위 (V)
MODE 2 (FREQ=1.0040e+002)
전체 변위 (V)
MODE 3 (FREQ=1.0362e+002)
전체 변위 (V)
MODE 4 (FREQ=1.2751e+002)
전체 변위 (V)
MODE 5 (FREQ=1.3892e+002)
전체 변위 (V)
MODE 6 (FREQ=1.6206e+002)
전체 변위 (V)
MODE 7 (FREQ=1.8335e+002)
전체 변위 (V)
MODE 8 (FREQ=1.9789e+002)
모델
하중/경계
해석 및 결과
NODAL DISP
TOTAL , mm
+1.44325e+001
5.9%
+1.32298e+001
2.5%
+1.20271e+001
1.1%
+1.08244e+001
1.1%
+9.62169e+000
3.3%
+8.41898e+000
1.4%
+7.21627e+000
1.2%
+6.01356e+000
1.2%
+4.81085e+000
1.3%
+3.60813e+000
1.3%
+2.40542e+000
1.6%
+1.20271e+000
78.1%
+0.00000e+000
Y
X
Z

보강재 완성 및 해석결과

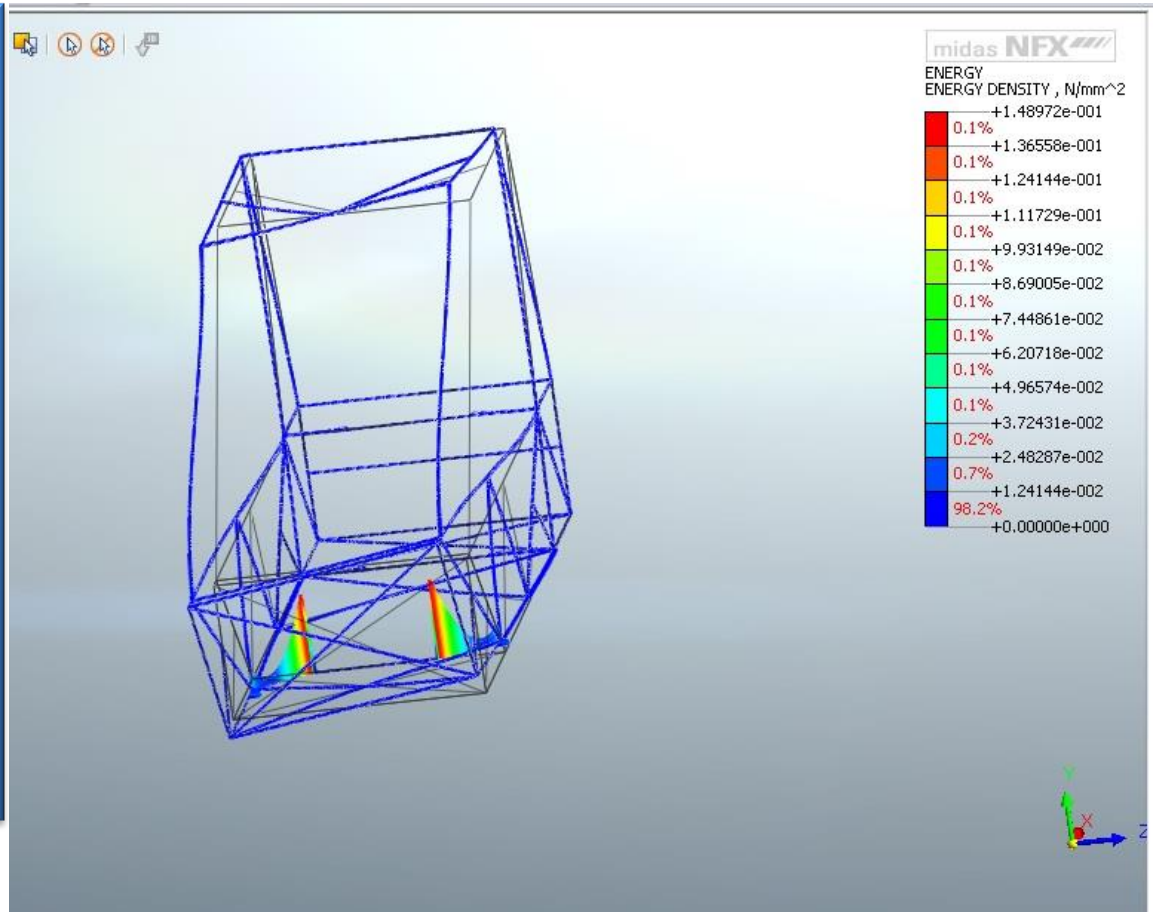

NODAL DISP
T2 , mm
+1.07788e+000
0.0%
+8.98237e-001
2.6%
+7.18590e-001
7.5%
+5.38942e-001
4.7%
+3.59295e-001
7.3%
+1.79647e-001
27.8%
+0.00000e+000
27.9%
-1.79648e-001
7.3%
-3.59295e-001
4.7%
-5.38942e-001
7.5%
-7.18590e-001
2.6%
-8.98237e-001
0.0%
-1.07788e+000

보강재 완성 및 해석결과


굽힘
• 1700N
• 변위 1.07mm
• K=1589N/mm
비틀림
• 4000× 737mm
• 4.81E-3rad
• 612E3Nm/rad
진동수
• 41.77Hz
무게
• 60.45kg

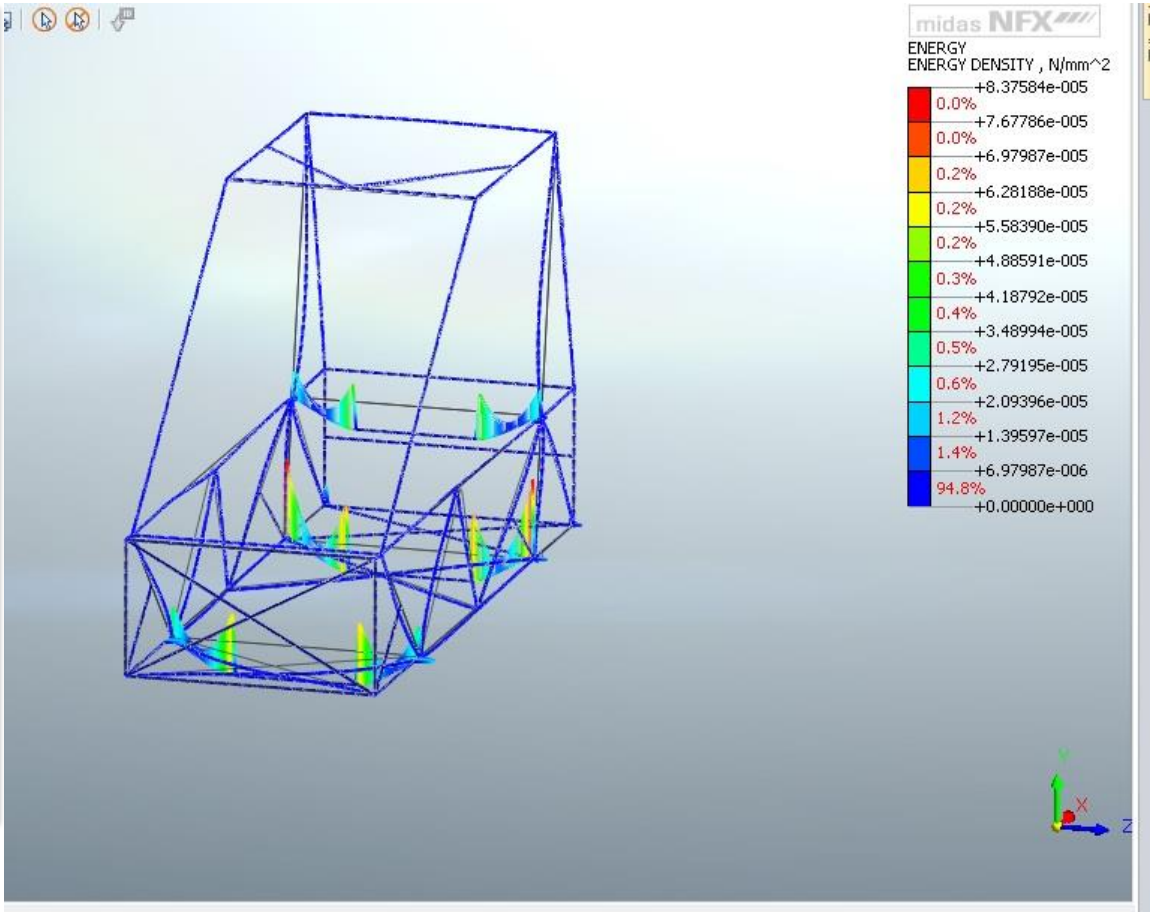
치수 최적화

굽힘 에너지 밀도



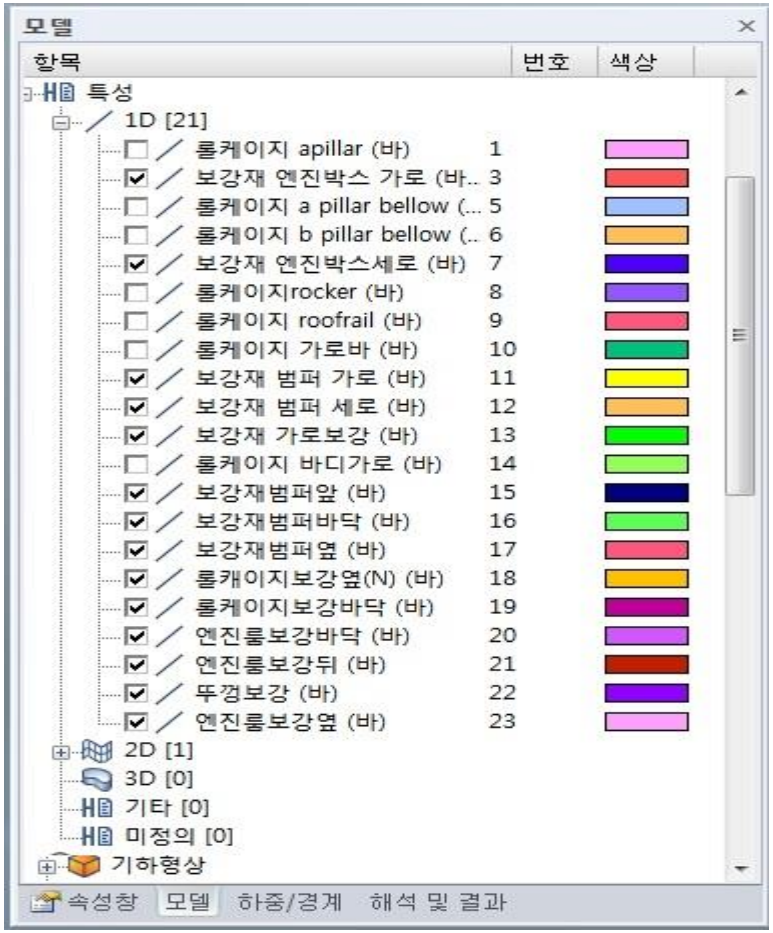
치수 최적화

비틀림 에너지 밀도



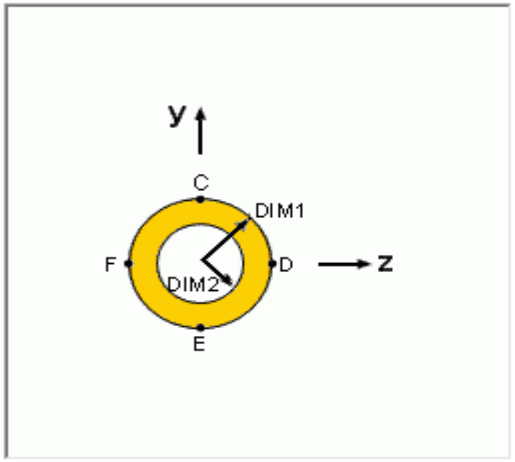
치수 최적화

- 단면 치수 변경 부분
  - ROLL CAGE를 제외한 나머지 부분



치수 최적화

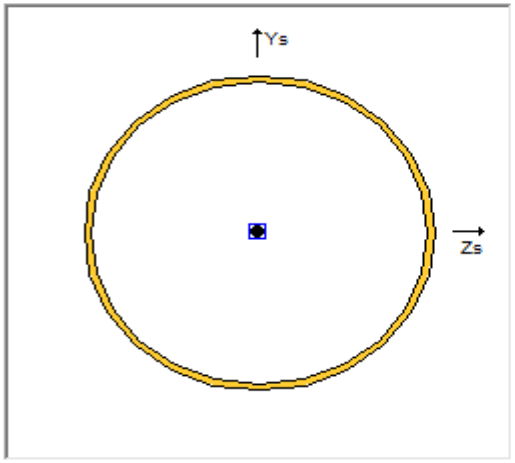
- 단면 치수 변경



Tube

DIM1 25 mm

DIM2 24.1 mm



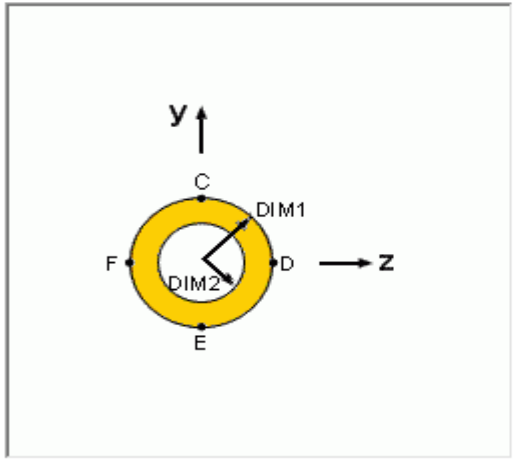
절점에서 전단중심의 거리

DY 0 mm

DZ 0 mm

< 전단중심 >

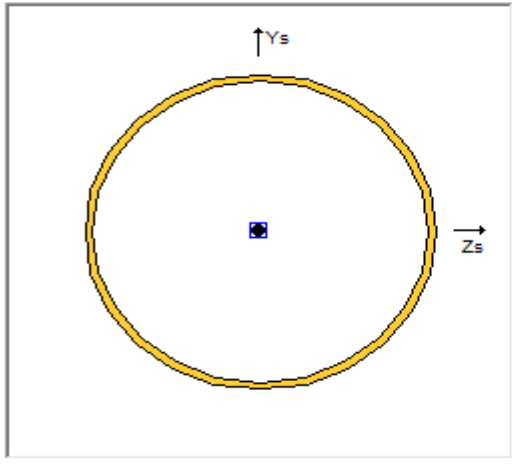
확인 취소



Tube

DIM1 20 mm

DIM2 19.1 mm



절점에서 전단중심의 거리

DY 0 mm

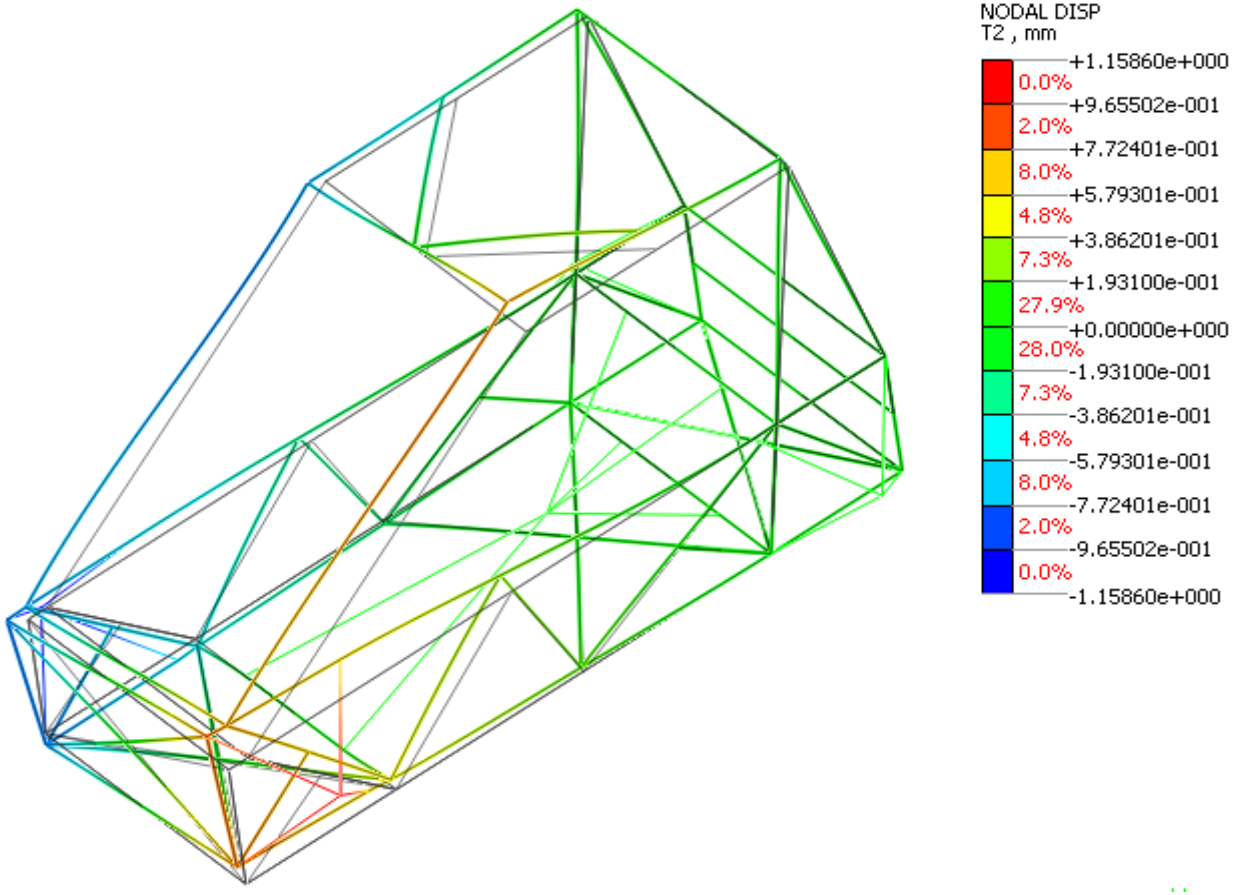
DZ 0 mm

< 전단중심 >

확인 취소

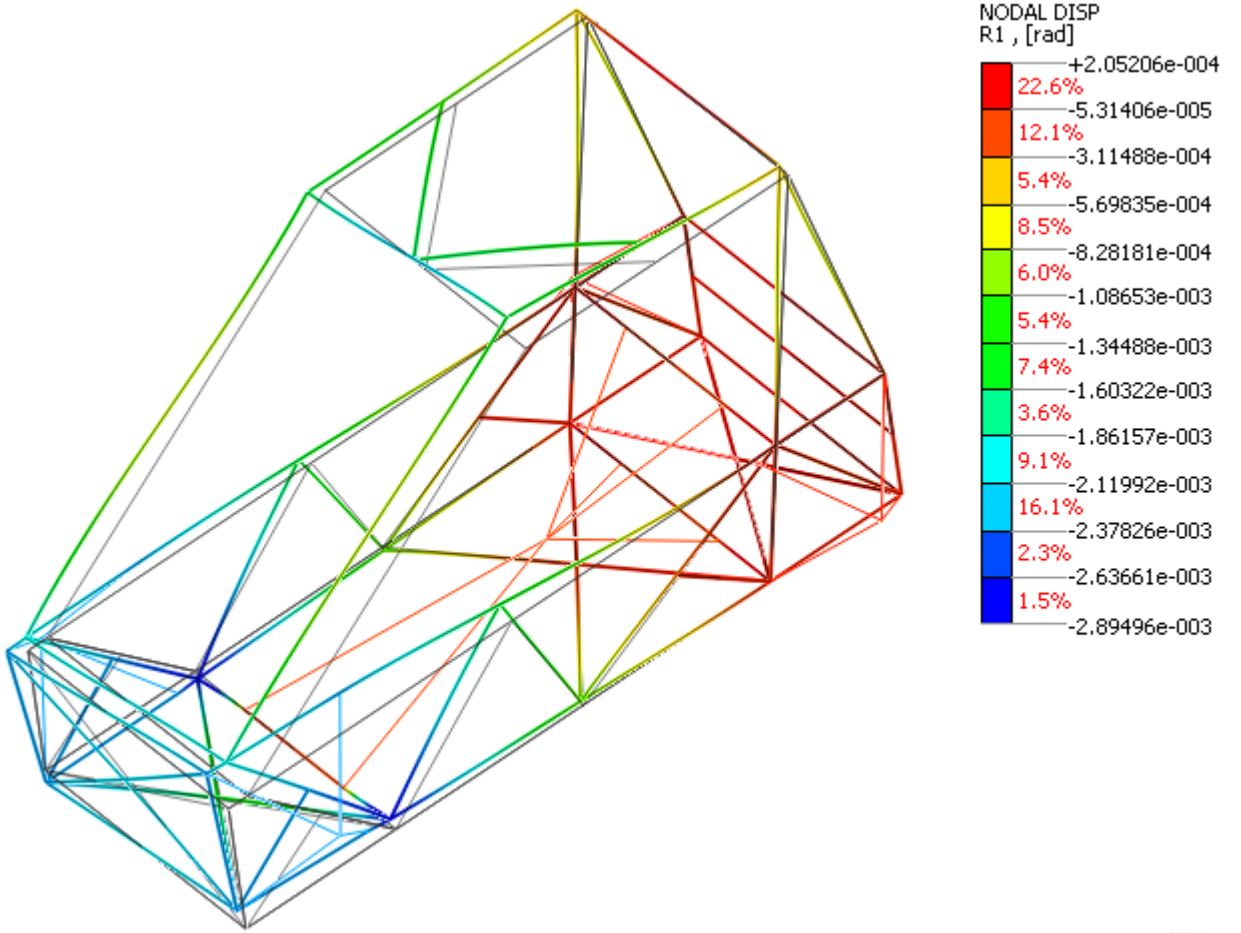
결과

- 굽힘해석 결과


NODAL DISP
T2 , mm
+1.15860e+000
0.0%
+9.65502e-001
2.0%
+7.72401e-001
8.0%
+5.79301e-001
4.8%
+3.86201e-001
7.3%
+1.93100e-001
27.9%
+0.00000e+000
28.0%
-1.93100e-001
7.3%
-3.86201e-001
4.8%
-5.79301e-001
8.0%
-7.72401e-001
2.0%
-9.65502e-001
0.0%
-1.15860e+000

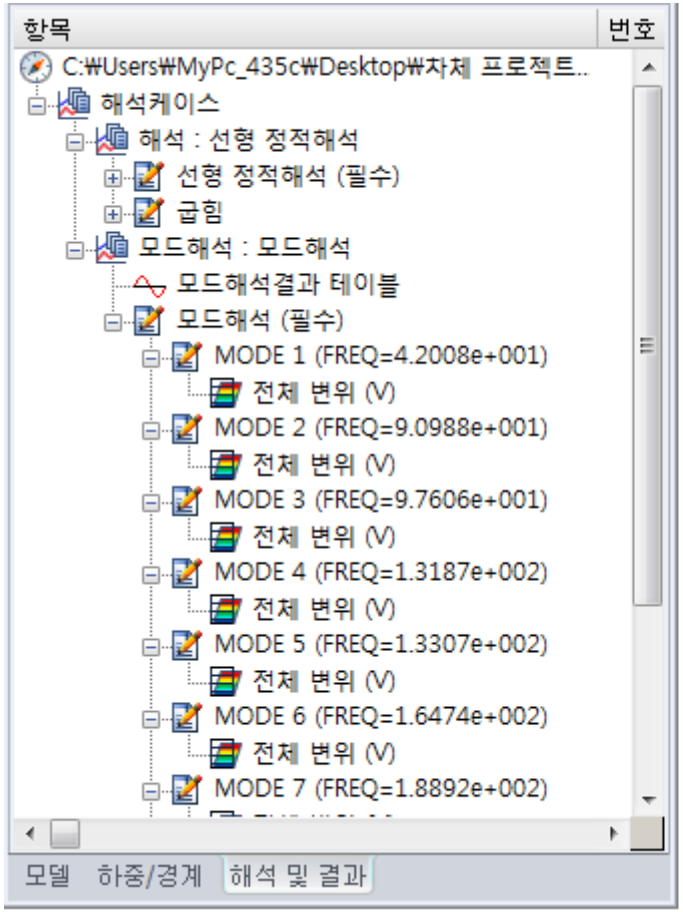
결과

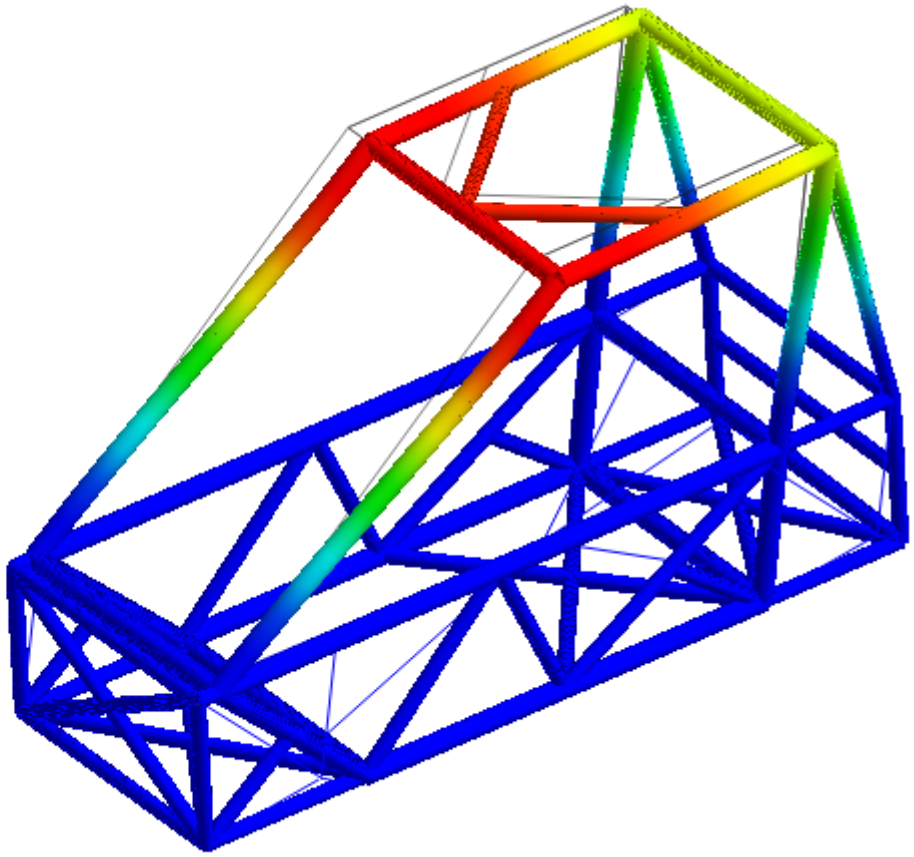
- 비틀림해석 결과


NODAL DISP
R1 , [rad]
+2.05206e-004
22.6%
-5.31406e-005
12.1%
-3.11488e-004
5.4%
-5.69835e-004
8.5%
-8.28181e-004
6.0%
-1.08653e-003
5.4%
-1.34488e-003
7.4%
-1.60322e-003
3.6%
-1.86157e-003
9.1%
-2.11992e-003
16.1%
-2.37826e-003
2.3%
-2.63661e-003
1.5%
-2.89496e-003

결과

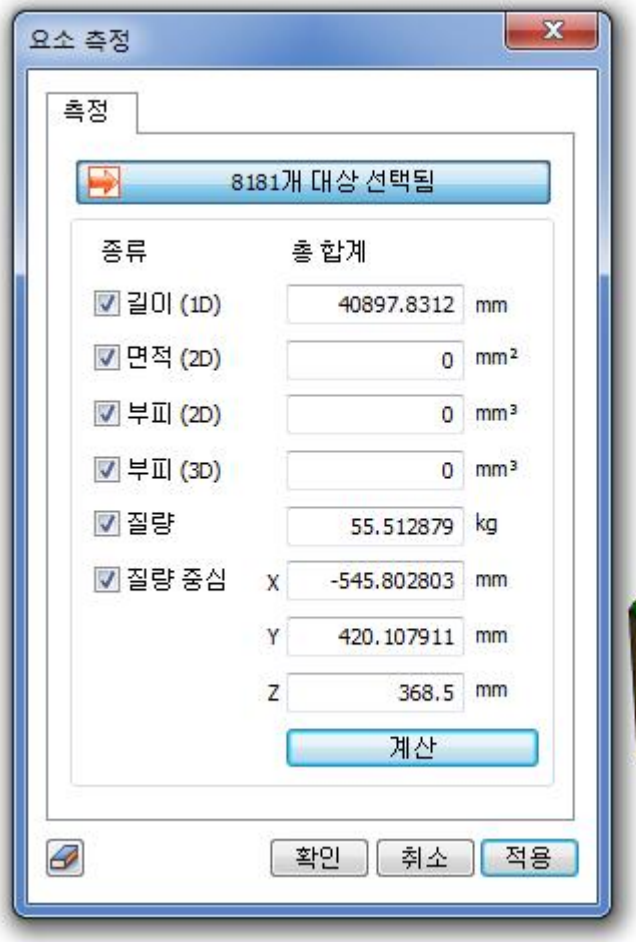
- 모드해석결과(주파수 확인)

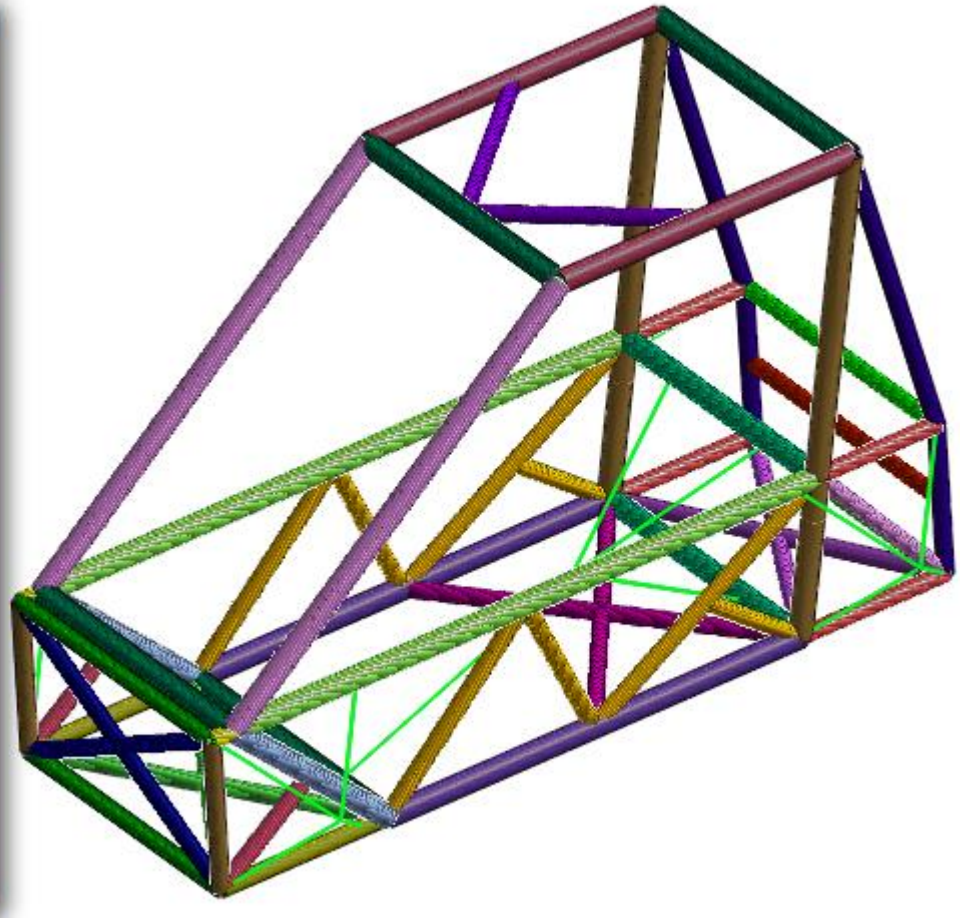




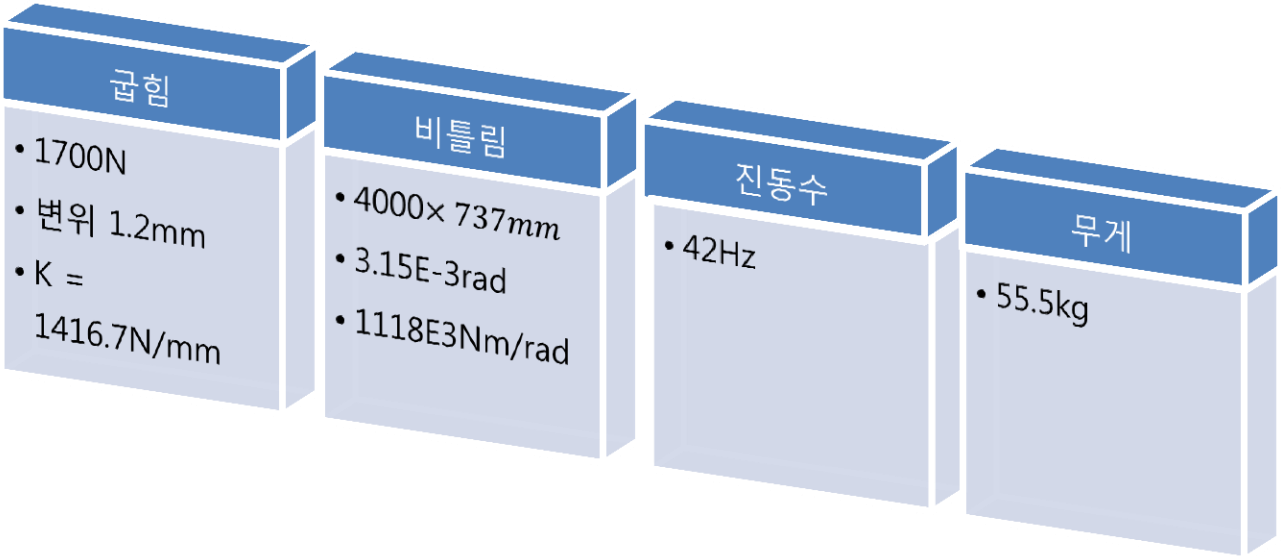
결과

- 총 무게


요소 측정
측정
8181개 대상 선택됨
종류
총 합계
길이 (1D)
40897.8312
mm
면적 (2D)
0
mm²
부피 (2D)
0
mm³
부피 (3D)
0
mm³
질량
55.512879
kg
질량 중심
X
-545.802803
mm
Y
420.107911
mm
Z
368.5
mm
계산
확인
취소
적용



결과


굽힘
• 1700N
• 변위 1.2mm
• K = 1416.7N/mm
비틀림
• 4000× 737mm
• 3.15E-3rad
• 1118E3Nm/rad
진동수
• 42Hz
무게
• 55.5kg

QnA

끝.
감사합니다.