Hi, FEA

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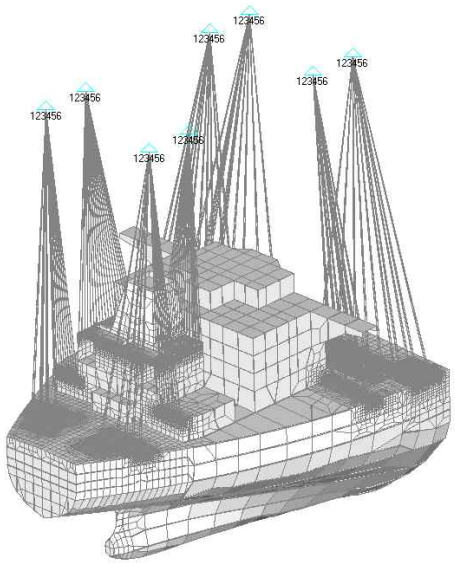
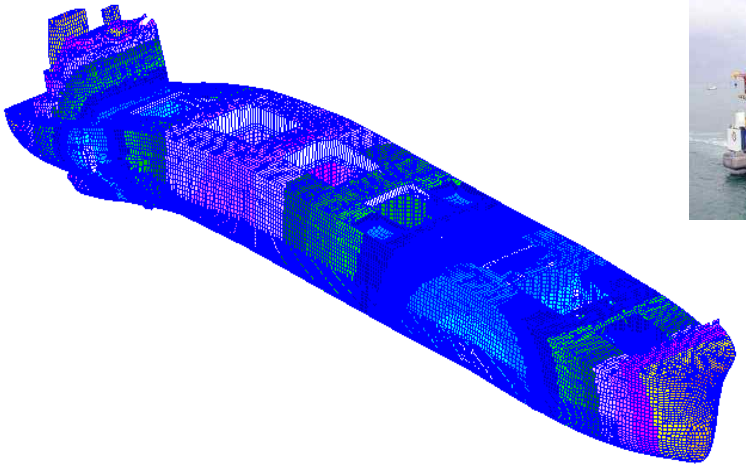
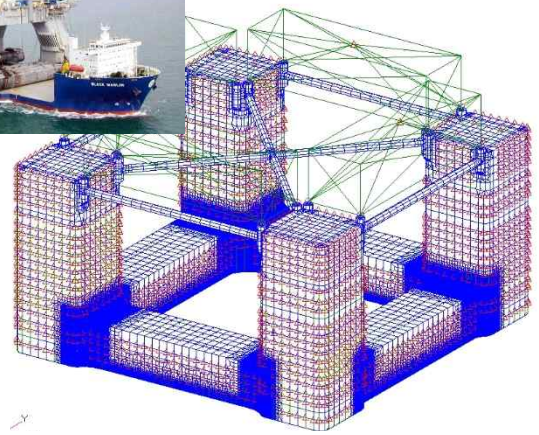
회 사 소 개 서
㈜삼원밀레니어







Samwon Millennia

(주)삼원밀레니어

Table of Contents

ⓒ 2022 SAMWON

1. 회사 개요

업 체 명	(주)삼원밀레니어	대 표 자	이 지 현
설 립 일 자	2001년 09월 14일	주 생 산 품	엔지니어링 서비스, 신재생에너지 설비 외
본 사 소 재 지	경기도 용인시 기흥구 중부대로 184 기흥힉스유타워 지식산업센터 A동 1607호		

※ 2011. 05 벤처기업 확인 (제20110102364호)

※ 2002. 07 기술연구소 인정 (제20021972호)

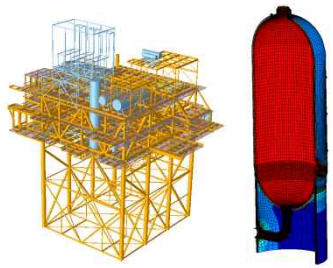
※ 2016. 04 청년 친화 강소기업 인증

※ 2020. 07 수출 유망 중소기업 지정

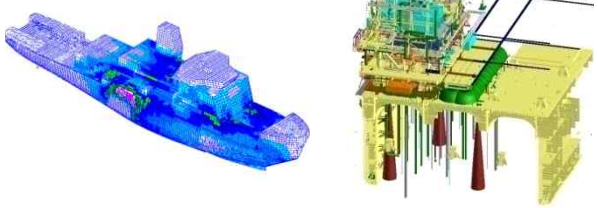
※ 2020. 11 일자리 창출 우수기업 인증

※ 2023. 05 메인비즈 확인 (제230601-01292호)

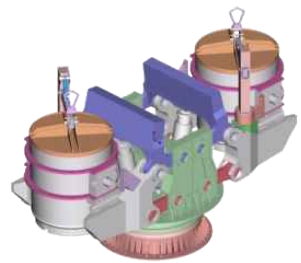
※ 2023. 10 이노비즈 확인 (제230601-01487호)



플랜트



조선/해양



제철설비

태양광 및 풍력 발전시스템

Samwon Millennia
(주)삼원밀레니어

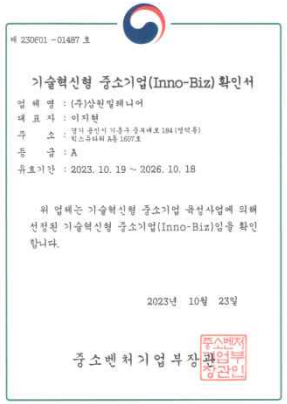
인증서 및 표창

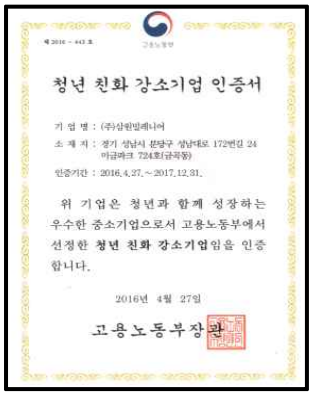
※ 대표이사 특허청장 표창(2022), 세계인명사전 등재(Who's Who)

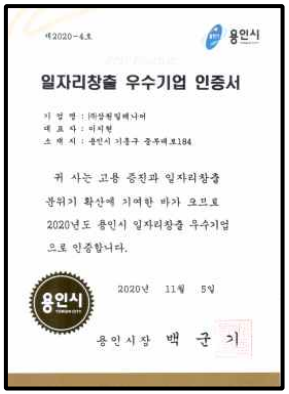
※ 벤처기업, 이노비즈, 메인비즈, 수출유망중소기업, 기술혁신기업 수상

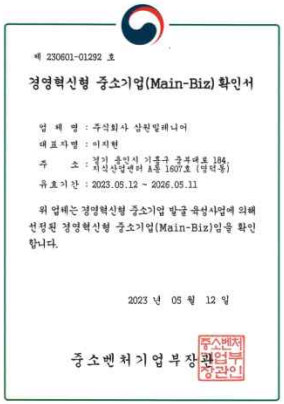
※ 일자리창출 우수기업 선정(2020년 용인시), 청년 친화 강소기업 인증(노동부,2016)

※ 우수논문발표상 4회





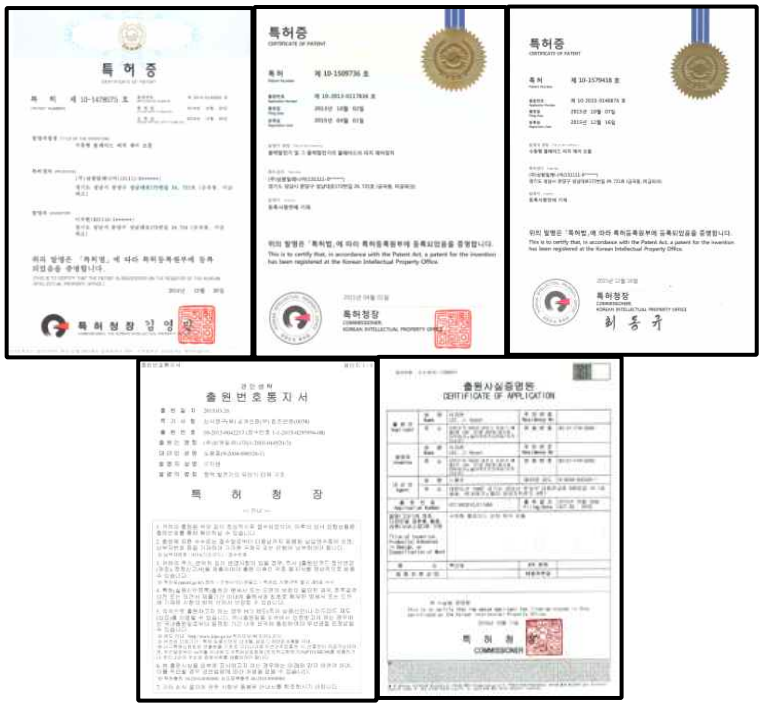




지적재산권 현황

- 2022년 특허청장상 수상
- 풍력발전기관련 특허 : 국내 특허 등록 34건 출원 2건, 국제특허 5건(출원), 상표권 1건
- 논문 실적 : 총 43편 (SCI 논문 - 3편, 국내 논문 - 4편, 학술대회 발표 - 35편)
- 우수논문상 4회 수상

국내 특허
(등록 : 34건, 출원 : 2건)



국제 특허
(USA, Japan, China, EU)

논문 : 43편

2. 주요 고객

SAMSUNG 삼성중공업

미래를 개척하는 현대중공업

DSME

KRISO 한국해양과학기술원 부설 선박해양플랜트연구소

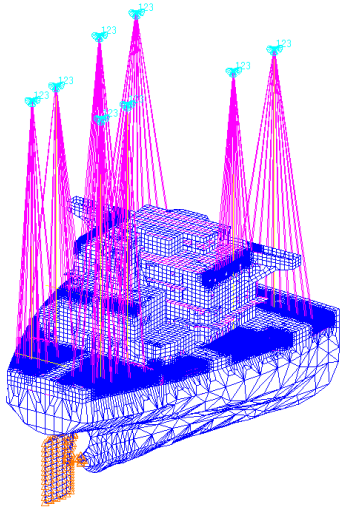
SUNGDONG

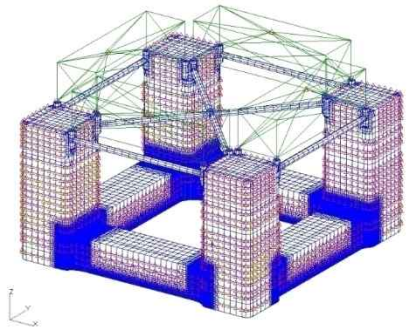
BUREAU VERITAS 1828 BUREAU VERITAS

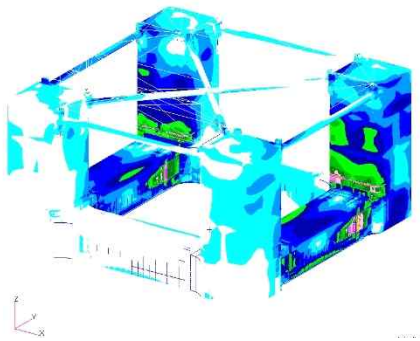
KOMAC KOREA MARITIME CONSULTANTS CO., LTD.

SPP

대한조선주식회사



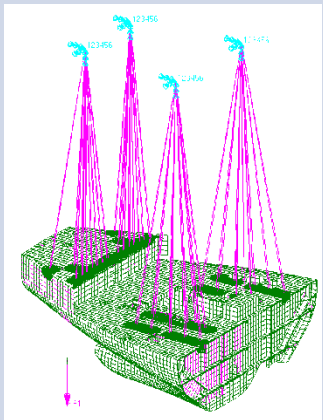




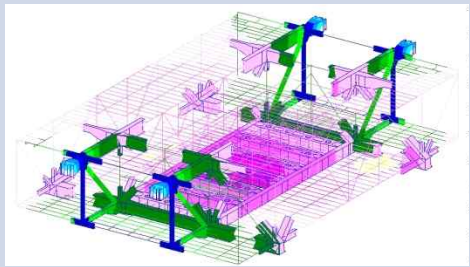
3. 주요 보유 기술

보유기술

Lifting

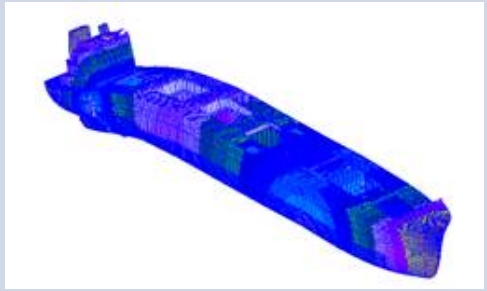


9500톤

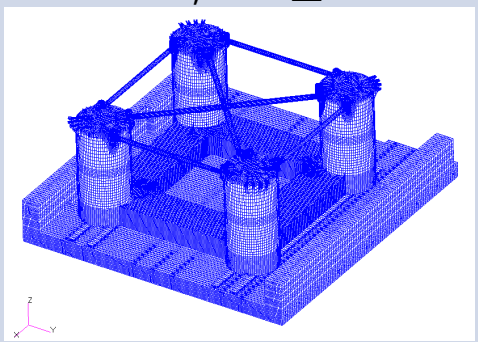


Topside 구조, 블록 Lifting시 구조적 안전성 검토

Loadout



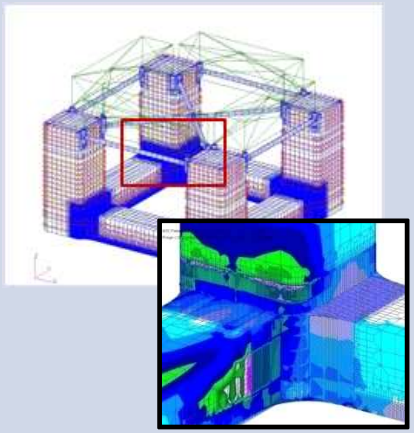
24,500톤



45,000톤

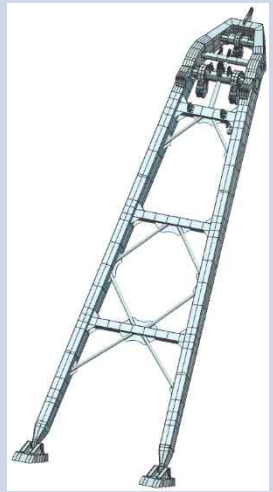
선박 및 FPU 등의 Loadout에 대한 엔지니어링

운송

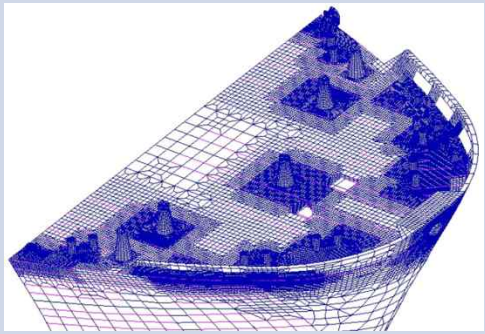


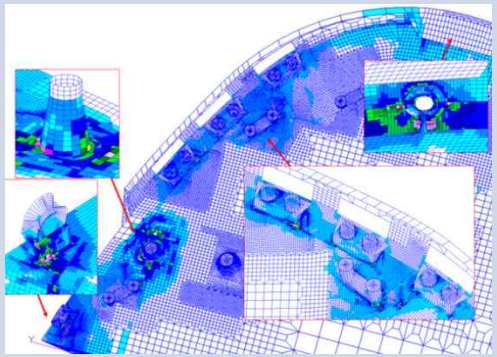
운송 시 선체의 구조적 안전성 검토

설치



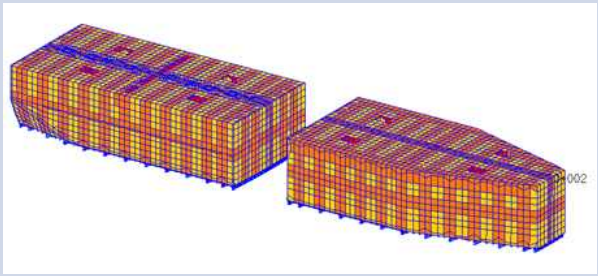
Mooring Fitting 하부해석

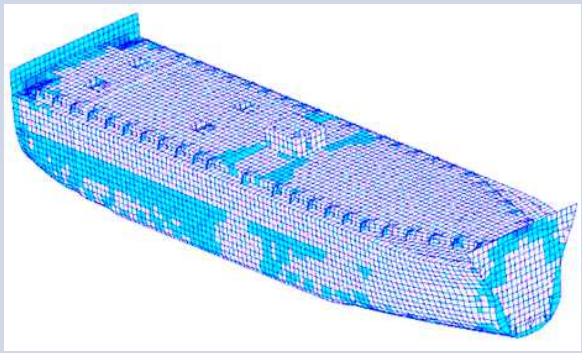




Mooring Fitting 하부의 구조 강도 평가

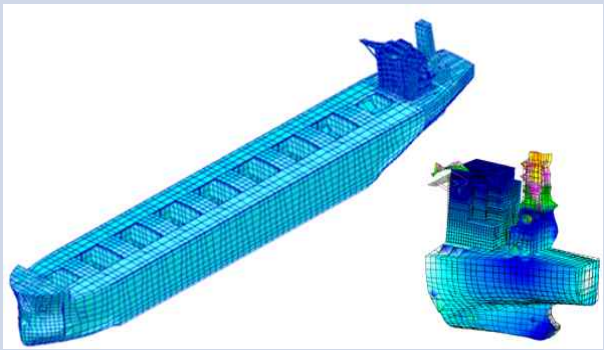
열전달/열응력 해석

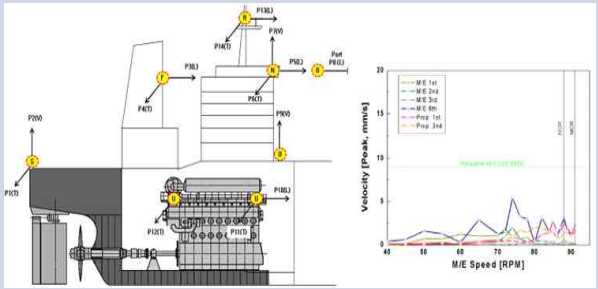




열전달 해석을 통한 열분포 계산 및 선체의 열응력 평가

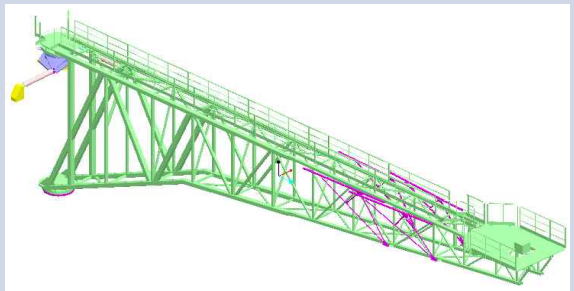
진동 해석 및 시험





전선 진동해석 및 계측

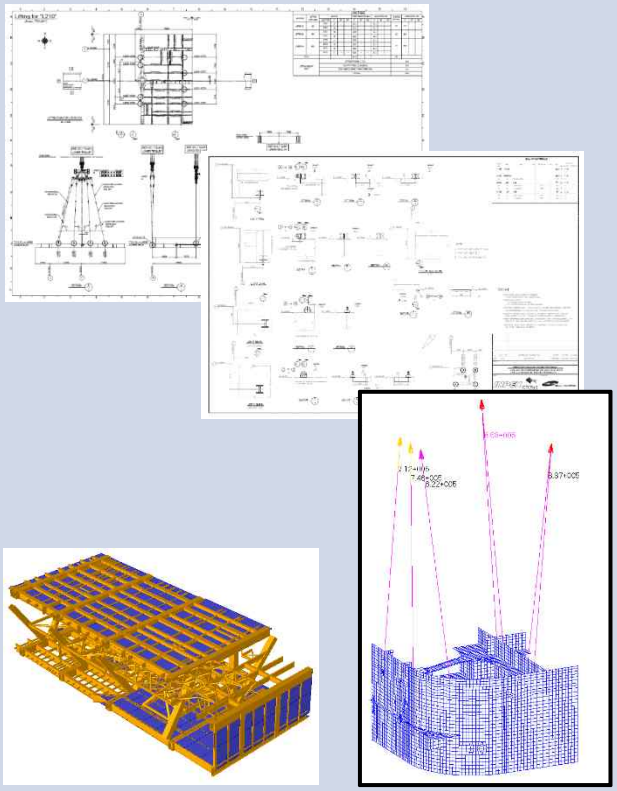
설계국산화(개발)



Burner boom 설계국산화
-3D CAD 및 CAE기술을
활용한 설계/해석/도면

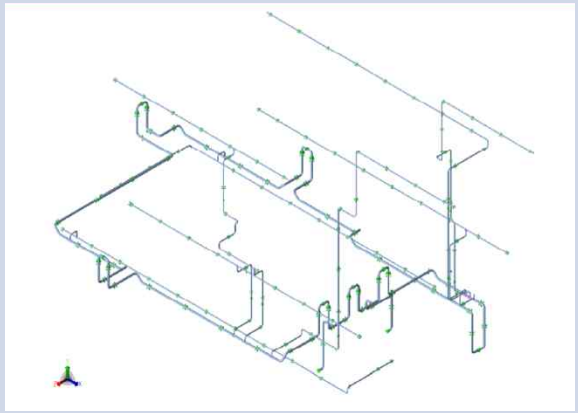
Jacket 설계/해석

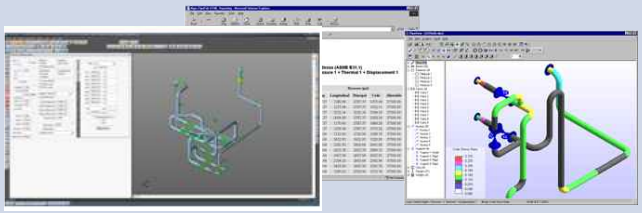
Block Handling (도면/해석)



도면(Sling, Lug Detail),
Analysis for Lifting & T/O

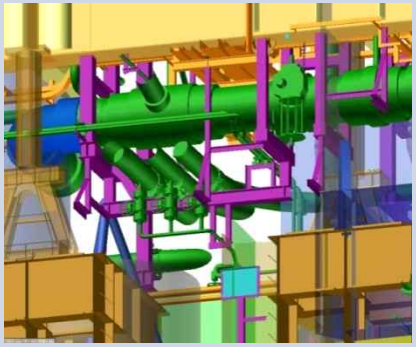
배관응력해석

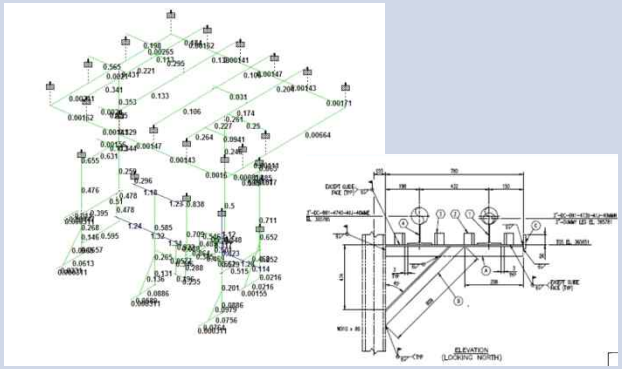




Pipe Stress Analysis
(ASME B31.1 & B31.3)

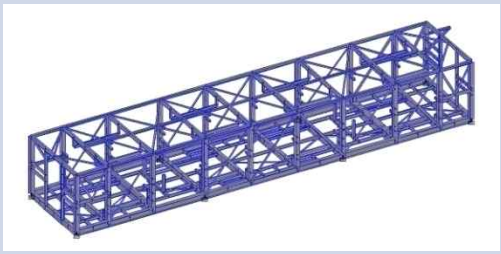
Pipe Support 해석





Pipe Support의 구조해석

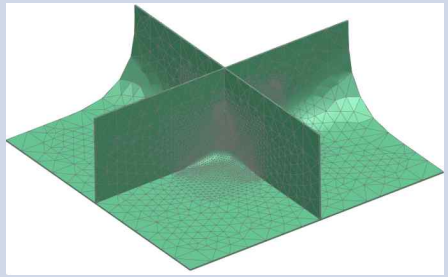
Steel Structure 해석

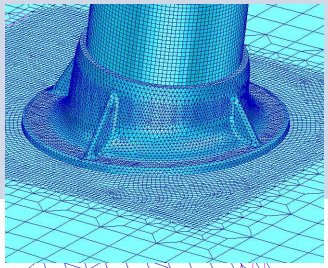


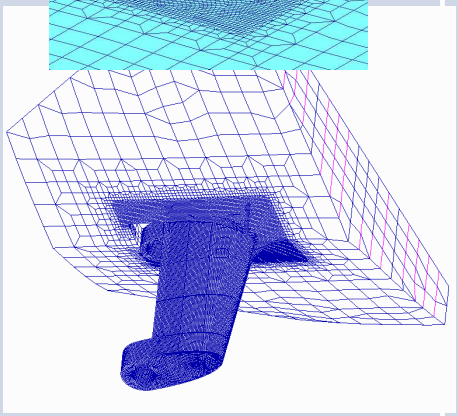
Steel Structure의 구조해석

보유기술

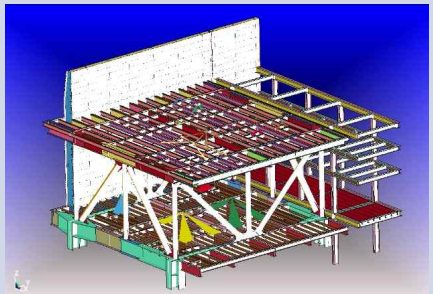
Solid FE Modeling

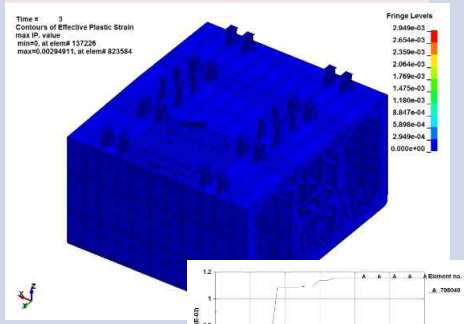


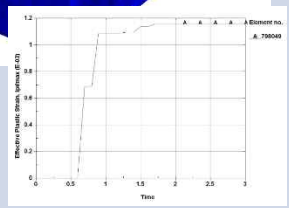




비선형 해석

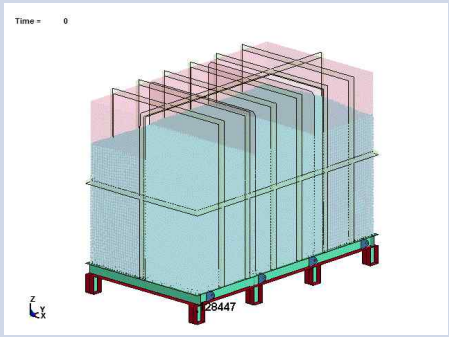


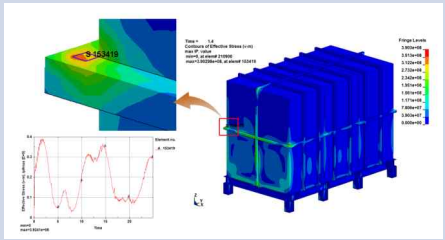




LS-DYNA, NASTRAN SOL600(MARC) 이용한
비선형 해석- Blast Analysis

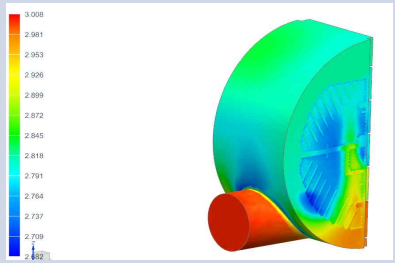
Slosh Analysis

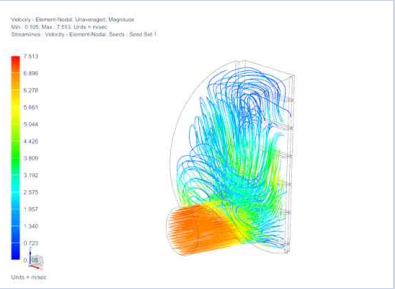




Sloshing을 고려한 구조물의
안전성 검토

CFD 해석

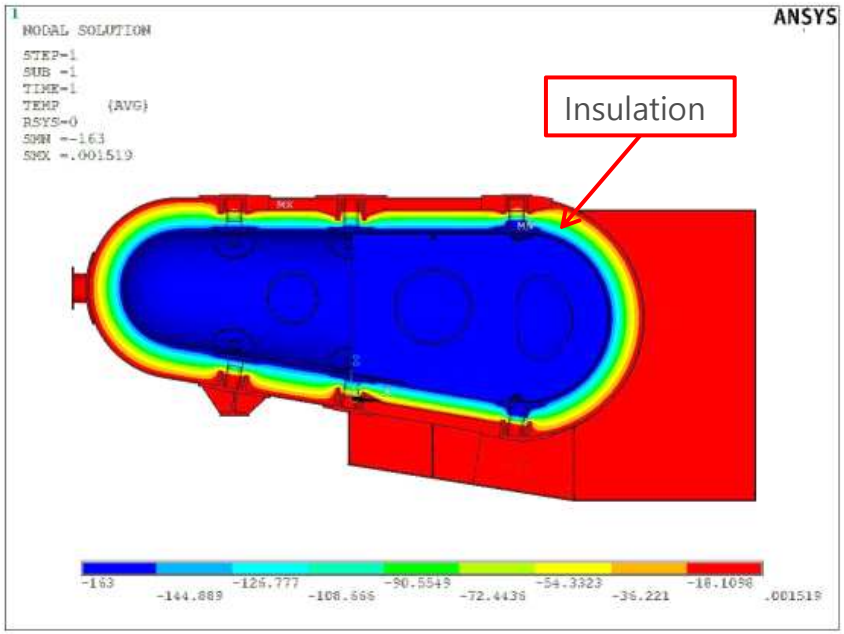




4. 주요 프로젝트 수행 실적

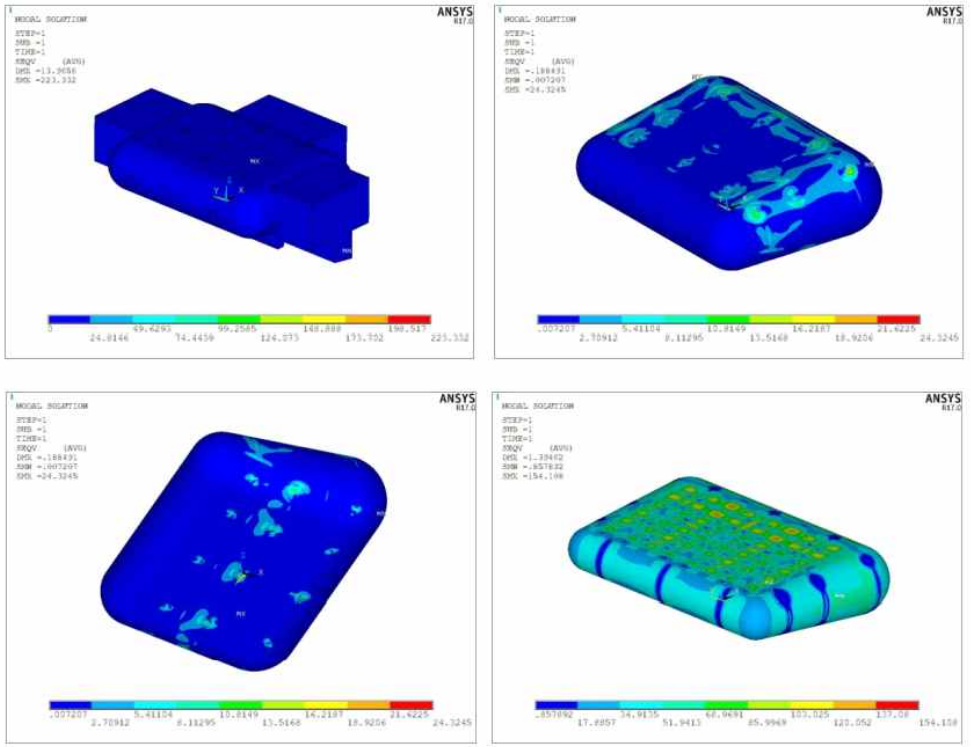
LPV LNG TANK 해석

- LNG 연료 탱크의 구조적 안전성 검토하기 위하여 열 해석 및 구조해석을 수행하였다.



Temperature distribution of LPV tank

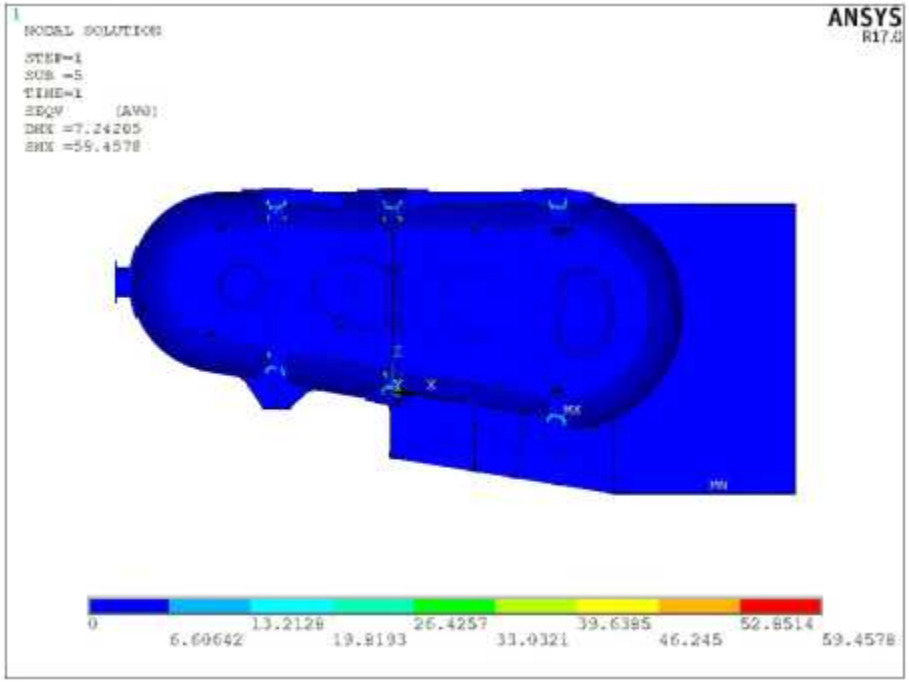
Specification of design loads and structural analysis of LPV
Yield and Buckling Analysis of LPV
Vibration Analysis of LPV
Temperature distribution of LPV
Temperature distribution and thermal stress analysis of LPV
Sloshing Analysis of LPV
Fatigue Analysis of LPV
Crack propagation Analysis of LPV
Reaction Forces of LPV



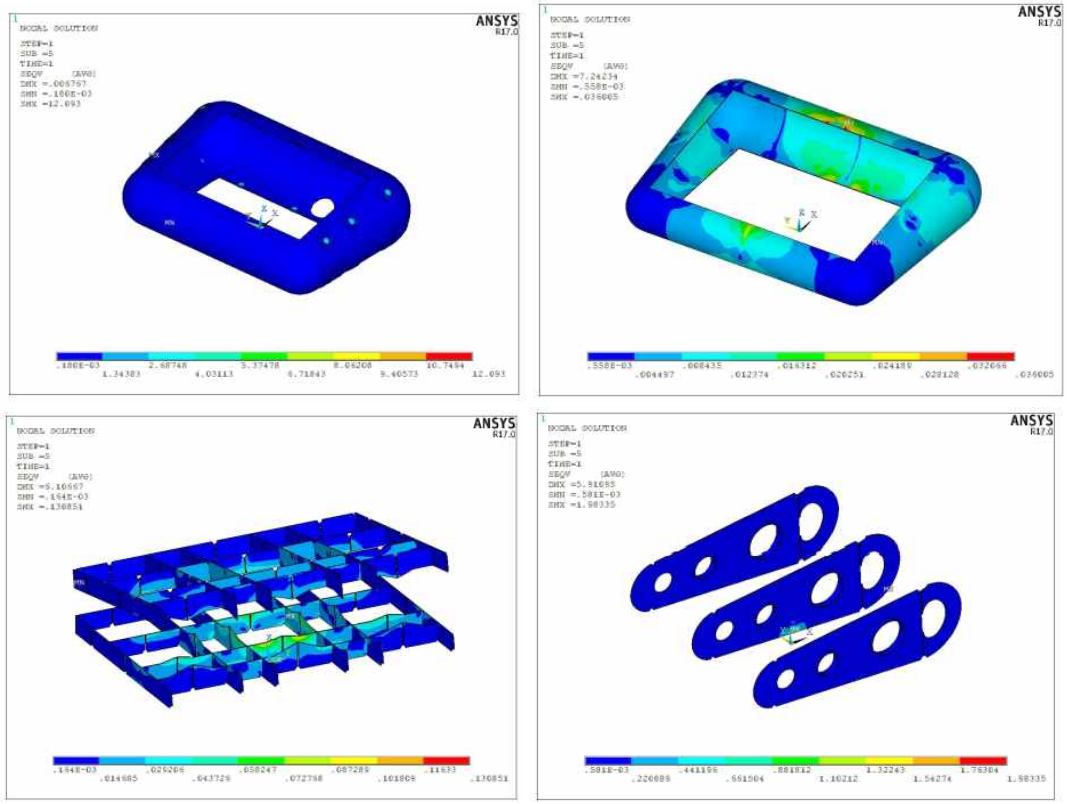
Von-Mises stress distribution of LPV tank

LPV LNG TANK 해석

- LNG 연료 탱크의 구조적 안전성 검토하기 위하여 열 응력 해석을 수행하였다.



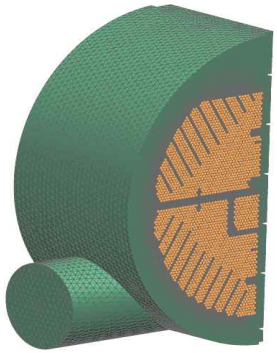
Thermal stress of LPV tank



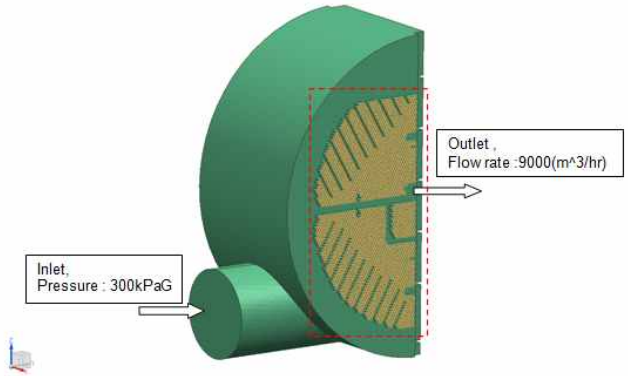
Thermal stress distribution of LPV tank

Surface Condenser(복수기) CFD 해석

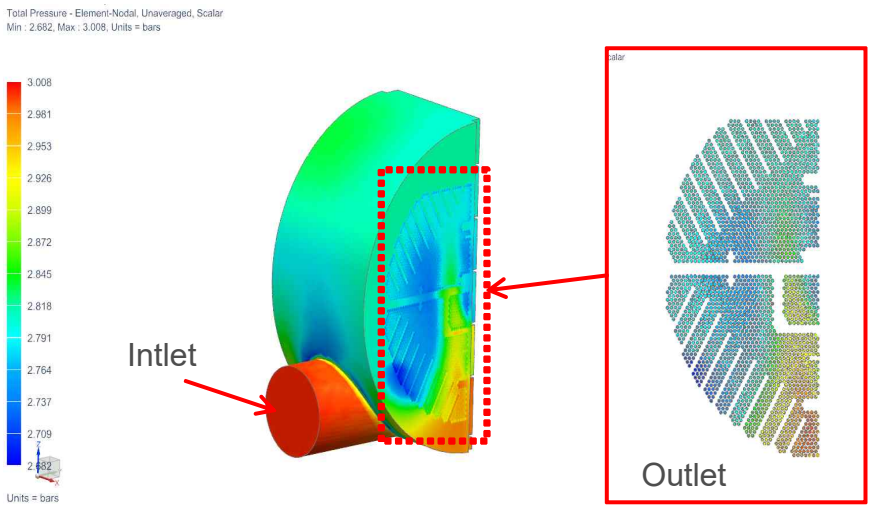
- 복수기 내부의 압력변화를 확인하기 위하여 유동해석을 수행하였다.



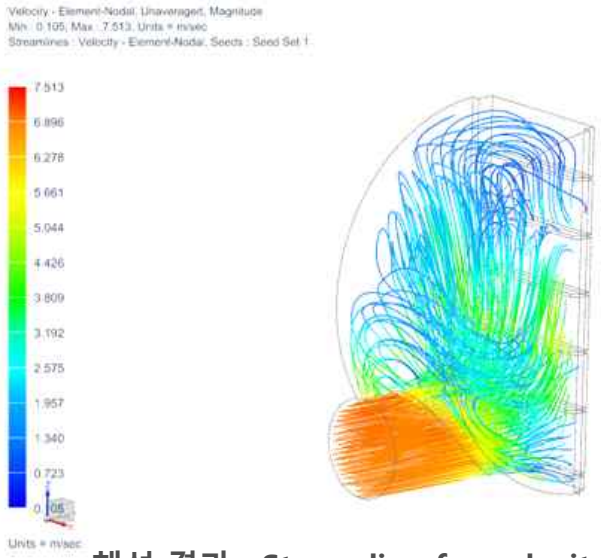
유한요소 모델



경계 조건



해석 결과 : Pressure



해석 결과 : Streamline for velocity

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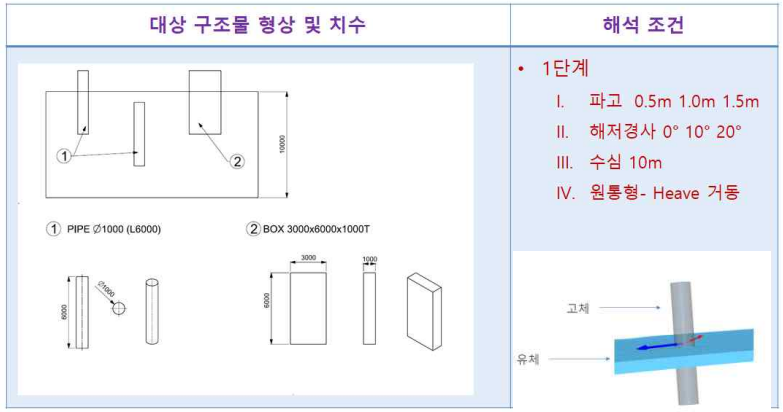
파력 발전 CFD 해석

- 다양한 설계조건에서 파랑 중 구조물의 거동해석 방법을 구축하고 이로부터 원통형 부유체에 대한 CFD 해석을 수행하였다.



형상 및 해석 조건

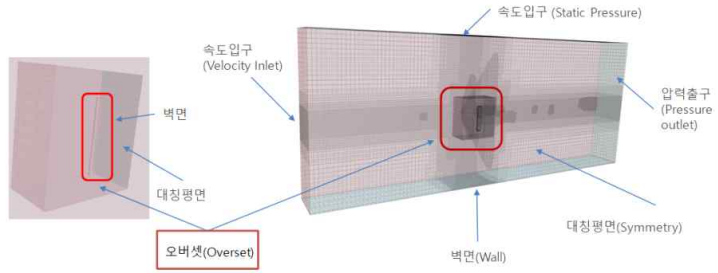
CFD 해석 범위 (22 Cases)

Case	Condition	Case	Condition	Case	Condition
1	0도, 0.5m 10s	9	10도, 1.0m 10s	17	20도, 1.5m 10s
2	0도, 0.5m 20s	10	10도, 1.0m 20s	18	20도, 1.5m 20s
3	0도, 1.0m 10s	11	10도, 1.5m 10s	19	0도, 1m, 3s
4	0도, 1.0m 20s	12	10도, 1.5m 20s	20	0도, 1m, 5s
5	0도, 1.5m 10s	13	20도, 0.5m 10s	21	0도, 1m, 7s
6	0도, 1.5m 20s	14	20도, 0.5m 20s	22	0도, 1m, 10s
7	10도, 0.5m 10s	15	20도, 1.0m 10s	19~22: JONSWAP WAVE	
8	10도, 0.5m 20s	16	20도, 1.0m 20s		

- 수심(D) : 10m
- 파고(H) : 0.5m, 1.0m, 1.5m
- 해저 경사(deg) : 0°, 10°, 20°
- 주기(T) : 10s, 20s(Stokes waves)
- 주기(T) : 3s, 5s, 7s, 10s (JONSWAP waves)
- 실린더의 높이 : 6m
- 실린더의 직경 : 1m
- 비중(S) : 0.5m

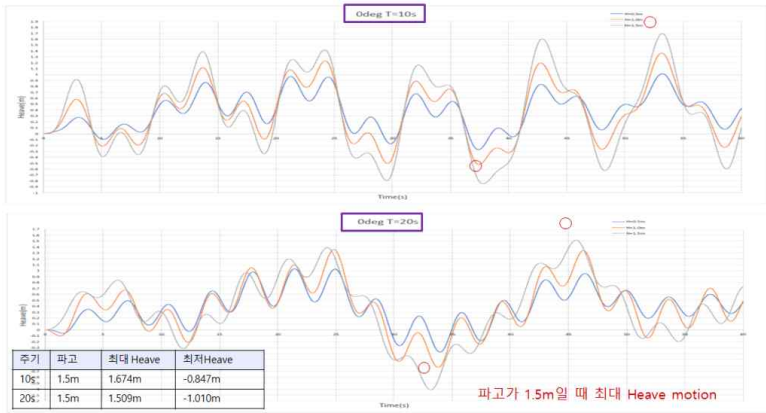
- **격자 : 오버셋 Mesh**
  여러 블록에서 동시에 발생하는 다양한 물리적 현상의 모델링 가능

Part	Boundary Type
Wave.Inlet	Velocity Inlet
Wave.Outlet	Pressure Outlet
Wave.Bottom	Wall
Wave.Symmetry	Symmetry
Cylinder.Bound	Overset
Cylinder.Cylinder_Surface	Wall
Cylinder.Symmetry	Symmetry



경계조건 및 격자 생성

경사면 0°에서 파고 H(0.5m, 1.0m, 1.5m)에 따른 Heave 비교



주기	파고	최대 Heave	최저Heave
10s	1.5m	1.674m	-0.847m
20s	1.5m	1.509m	-1.010m

해석 결과

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파력 발전 CFD 해석

- 다양한 설계조건에서 파랑 중 구조물의 거동해석 방법을 구축하고 이로부터 원통형 부유체에 대한 CFD 해석하였다.

Heave motion 해석 결과 정리

Case	주기(s)	H(m)	경사(°)	해수면 위로 최대 Heave(m)	해수면 밑으로 최대 Heave(m)	최대 Heave 범위(m)
1	10s	0.5	0	1.014	-0.271	1.285
2	20s	0.5	0	1.016	-0.374	1.39
3	10s	1.0	0	1.357	-0.520	1.877
4	20s	1.0	0	1.341	-0.634	1.975
5	10s	1.5	0	1.674	-0.847	2.521
6	20s	1.5	0	1.509	-1.010	2.519
7	10s	0.5	10	0.720	-0.411	1.131
8	20s	0.5	10	0.631	-0.371	1.002
9	10s	1.0	10	0.964	-0.625	1.589
10	20s	1.0	10	0.966	-0.596	1.562
11	10s	1.5	10	1.111	-0.666	1.777
12	20s	1.5	10	1.047	-0.844	1.891
13	10s	0.5	20	0.529	-0.397	0.926
14	20s	0.5	20	0.506	-0.332	0.838
15	10s	1.0	20	0.816	-0.600	1.416
16	20s	1.0	20	0.840	-0.673	1.513
17	10s	1.5	20	1.212	-0.906	2.118
18	20s	1.5	20	0.919	-0.943	1.862
	JONSWAP Wave					
19	3s	1.0	0	0.949	-0.178	1.127
20	5s	1.0	0	1.199	-0.427	1.626
21	7s	1.0	0	1.303	-0.470	1.773
22	10s	1.0	0	1.157	-0.401	1.558

가장 좋은 Heave 효율에 따른 Condition

- 수심(D): 10m (고정값)
- 비중(S): 0.5 (고정값)
- 파고(H):1.5m
- 해저 경사각(deg): 0°
- 주기(T): 10s
- 최대 Heave 범위: 2.521m

결과 분석 – 최대 Heave Motion Case 5

-Case 5

- 파고(H):1.5m
- 해저 경사각(deg): 0°
- 주기(T): 10s
- 최대 Heave 범위: 2.521m

해양구조물 개발(설계/제작/설치/시운전)

- 교량 높이 21m 통과하기 위한 동지 6호 및 7호 선박 개조 설계, 제작, 설치, 시운전

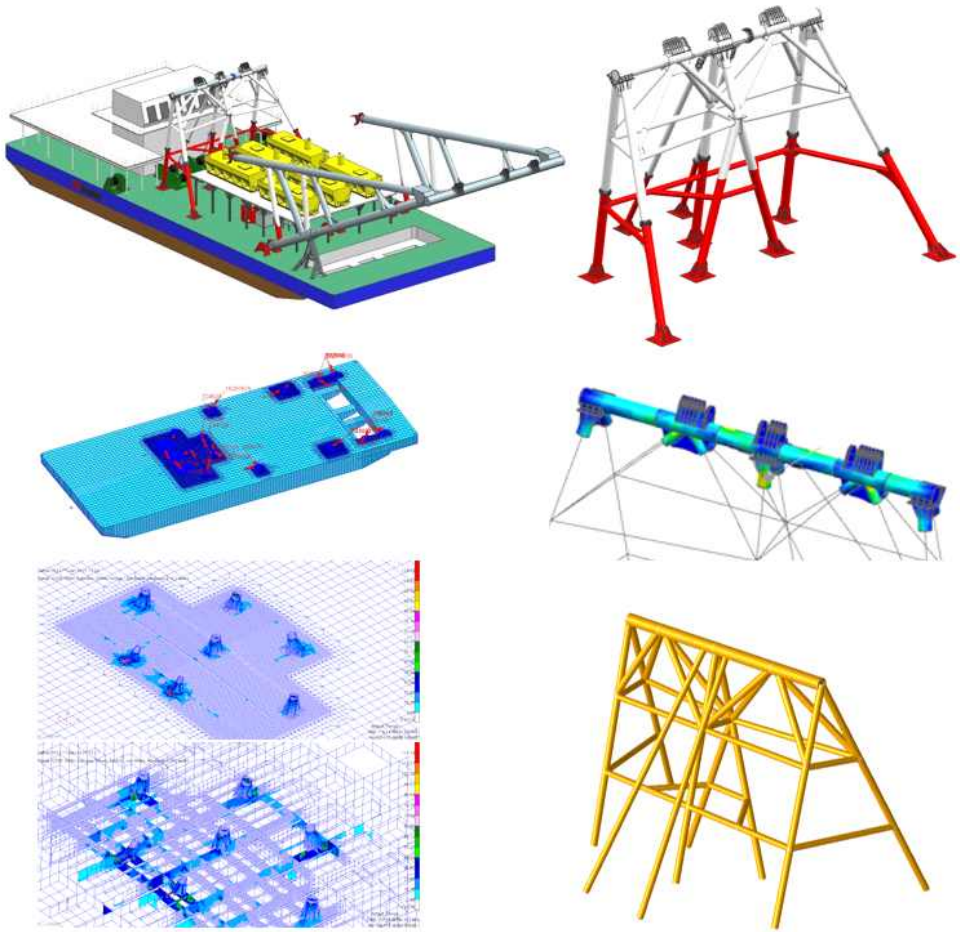
통과 예정 교량

동지 6호

동지 7호

해양구조물 개발(설계/제작/설치/시운전)

- 당사가 백타워(길이 14m x 폭 21m x 높이 14m)의 설계, 해석, 제작, 운송, 설치, 시운전을 턴키로 공사를 성공적으로 완료하였으며, 성능시험결과 해석결과와 로드셀 측정결과가 1.7%(해석하중=182.2톤, 로드셀하중=185.3톤) 차이를 보였음.



설계 및 구조안전성 평가

제작, 조립, 설치, 성능시험

해양구조물 개발(설계/제작/설치/시운전)

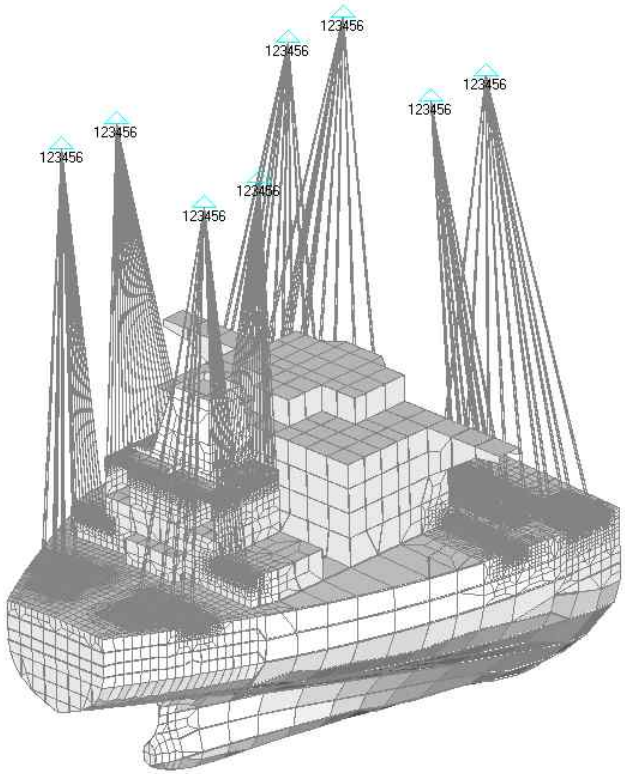
- **교량 통과 : A-FRAME 각도 27도**

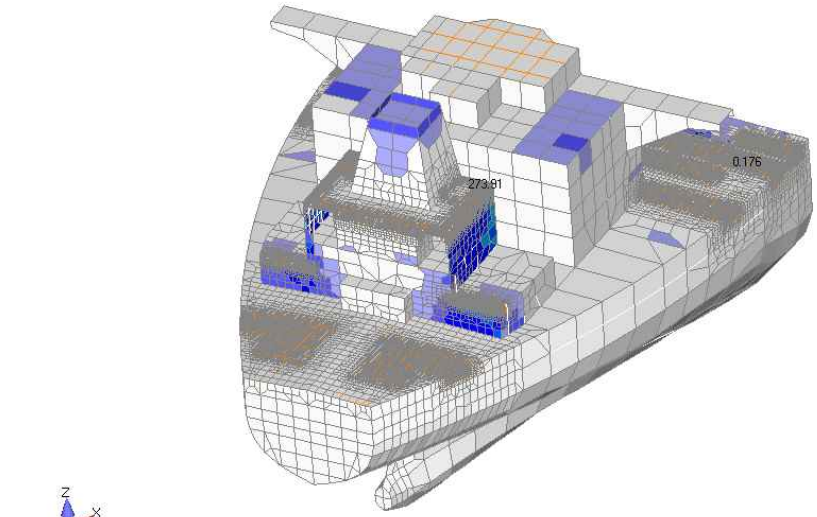
Lifting, Turn Over, Load Out, Transportation 주요실적

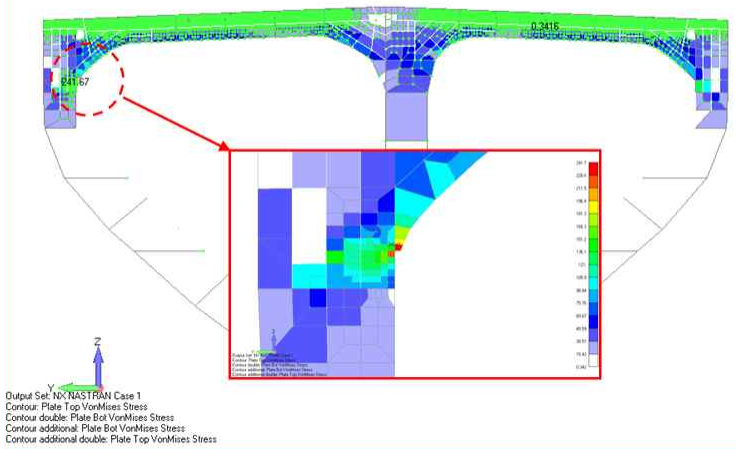
항 목	주요 실적
Lifting & Turn Over Analysis, Transportation Analysis	• Giga & Mega Block, 선수, 선미, Deck House …., **수행건수 : 220건**, **Max. Weight : 7180ton** (삼성중공업) • TLP Super Lifting 해석 (현대중공업) • NA KIKA Semi-Submersible Transportation Analysis (현대중공업)
Load-out 해석 (Ship, FPU, Floating Dock)	• 105K C.O.T. Load-out (현대중공업) • 82K LPG Carrier Load-out (현대중공업) • Appomattox FPU & Offshore Floating Dock Load-out (삼성중공업) • 8,800 TEU CLASS CONTAINER CARRIER & Floating Dock Load-out (성동조선해양) • S4001 6500 TEU CLASS CONTAINER Load-out (성동조선해양) • 93K PC선, 73K PC선, 47K PC선 Load-out (성동조선해양) • 26K 벌크선 Load-out (성동조선해양) • 컨테이너선 & Floating Dock Load-out (성동조선해양)
BLOCK HANDLING 도면 및 해석 (도면, Lifting & T/O Analysis)	• ICHTHYS CPF (삼성중공업) • Appomattox FPS(Hull) (삼성중공업) • CAT-J Jack-up Rig (삼성중공업)

Giga Block Lifting Analysis

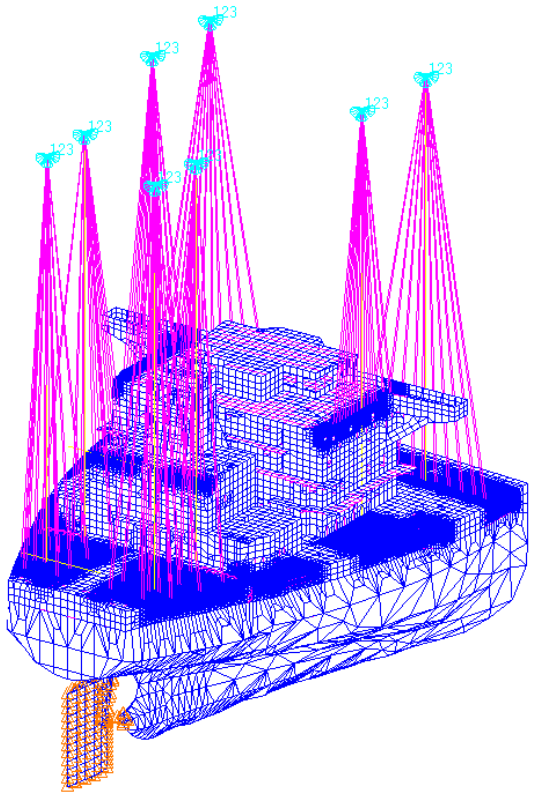
- Giga Block Lifting Analysis
- Weight = 7180ton

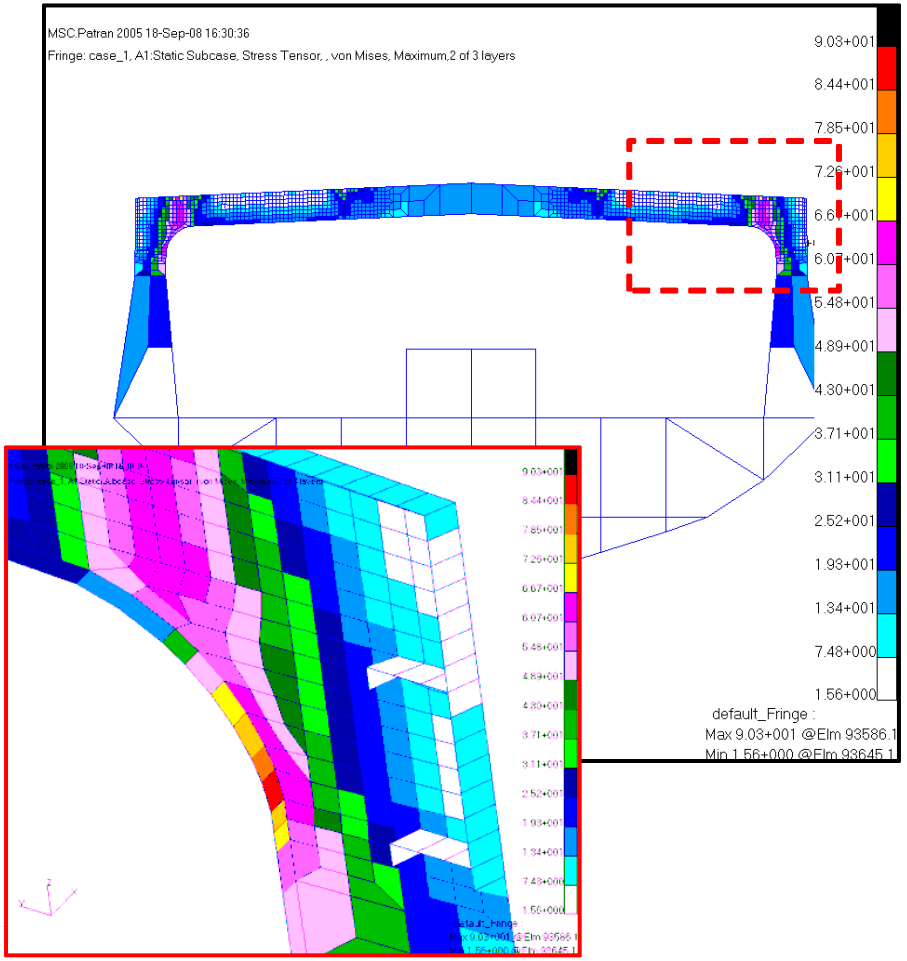






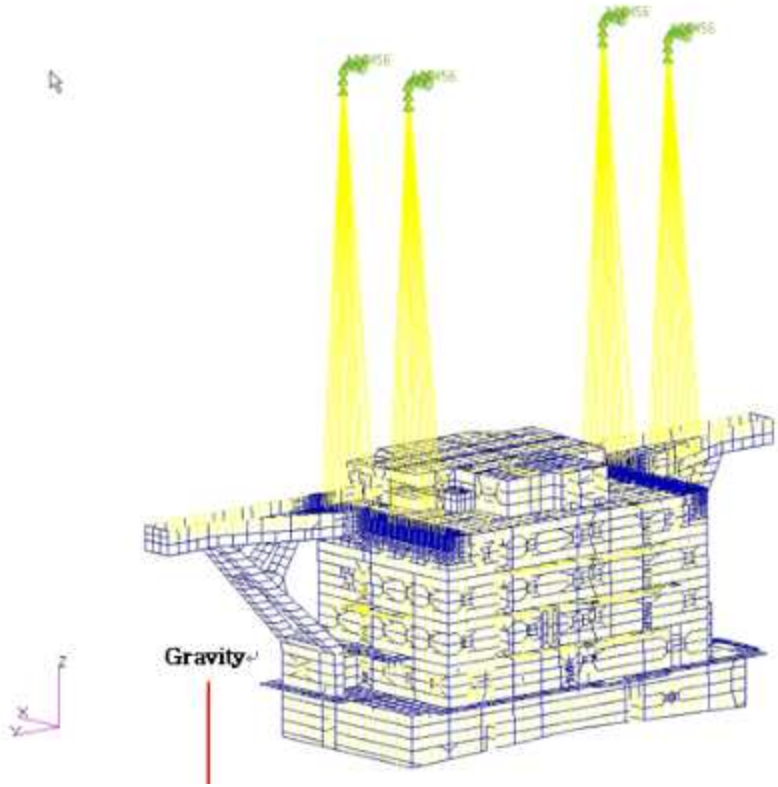
- 4830 ton Giga block의 lifting 조건 시 lug 주변부의 강도 평가.

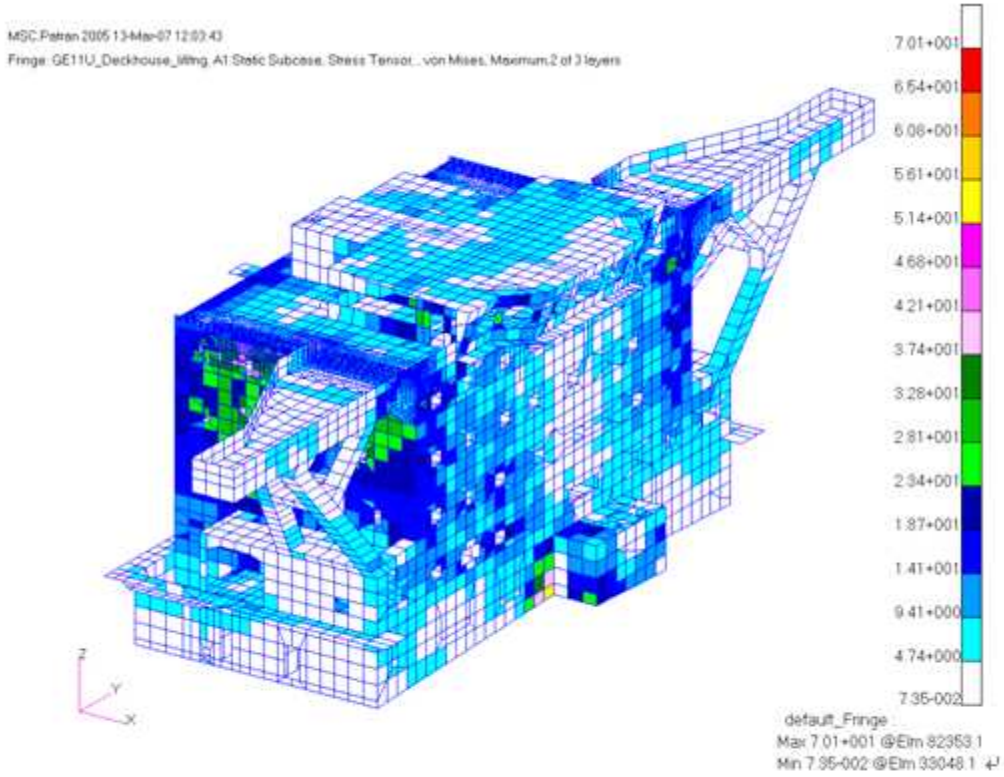




Deck House 리프팅 해석

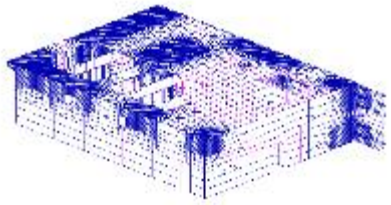
- 목적 : Deck House (Mega Block) Lifting 시 구조적 안전성 검토.



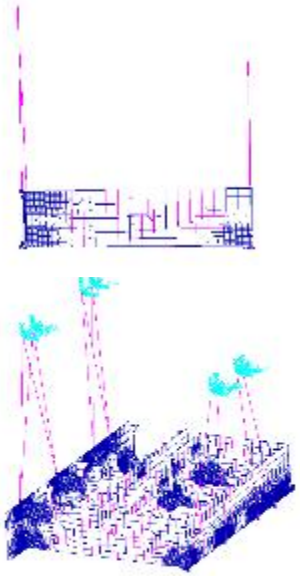


Strength analysis of blocks during T/O Stage

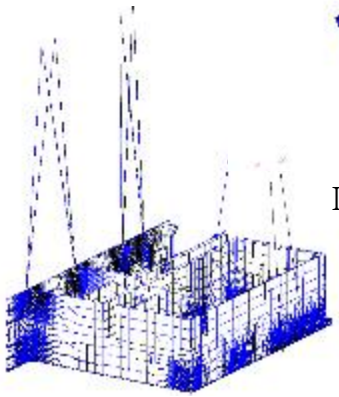
- Turn-over 조건에 대한 구조적 안전성 검토.



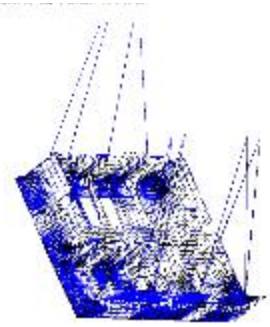
Block model



Boundary Condition(0°)

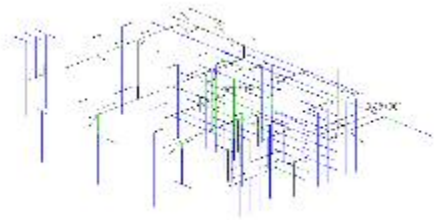


Deformation (0°)

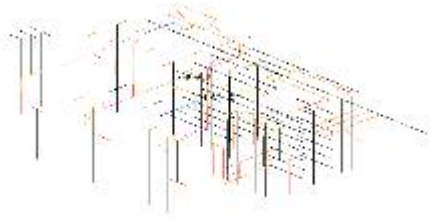


Deformation (45°)

Deformation (90°)

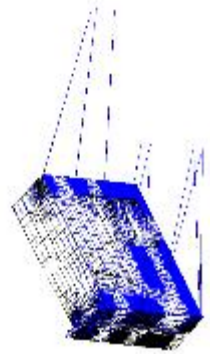


Max Bar stress (45°)



Min Bar stress (45°)

Deformation (180°)



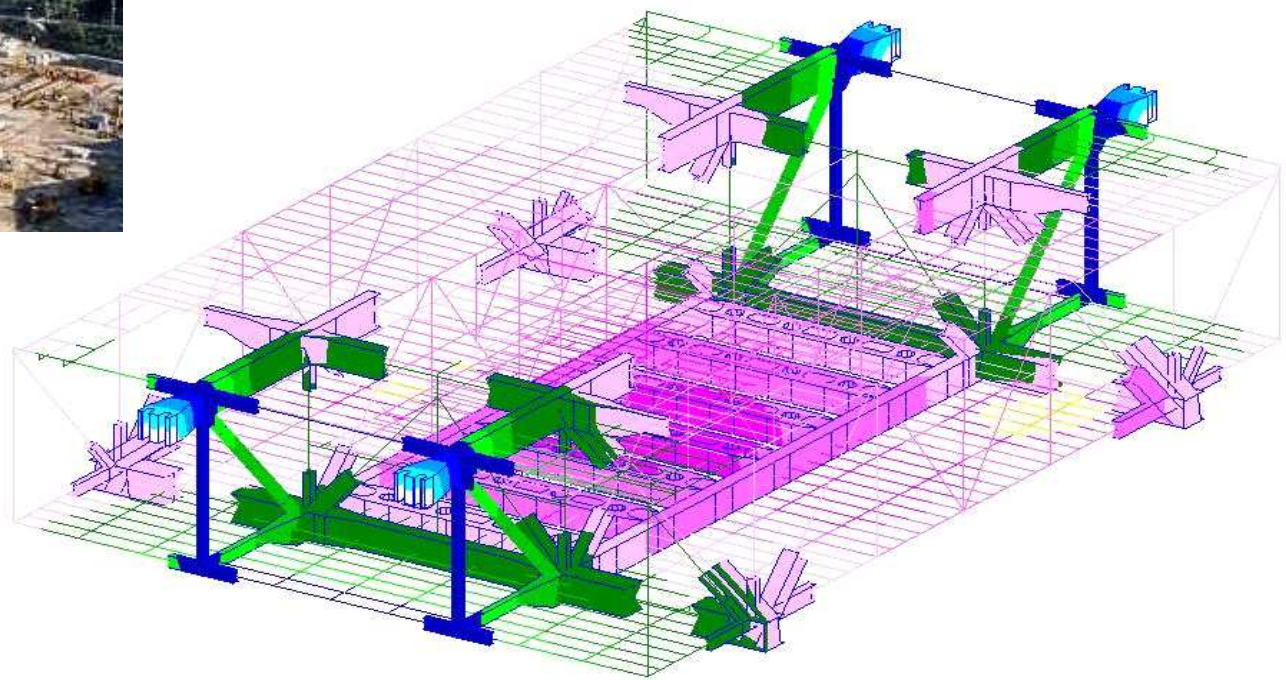
Deformation (135°)

TLP Super Lifting 구조 해석

- 목적 : Topside 구조물을 Super Lifting할 때 구조적 안전성을 검토하기 위함.
- 주요 관심은 Lifting 조건에서 Lifting Beam 평가와 Main Beam과 Secondary Beam의 거동이다.

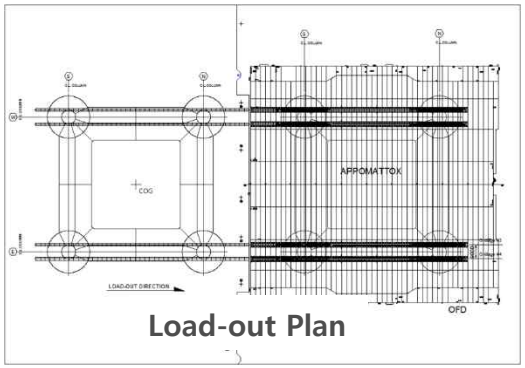
Applied Code & Specifications

- **API RP – 2A**
- **AISC ASD**

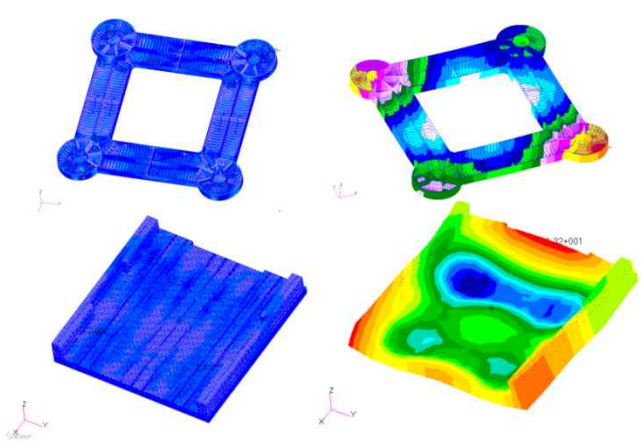


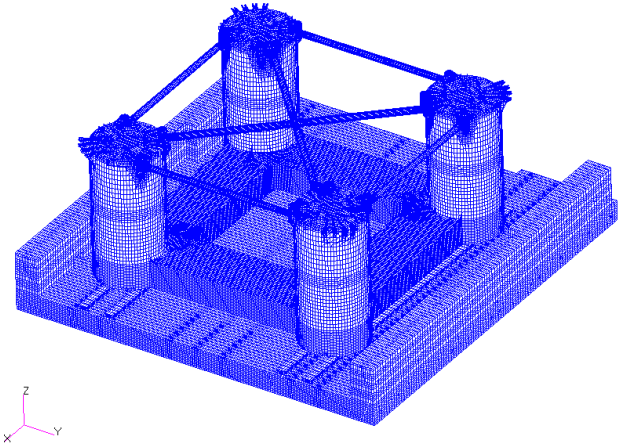
Appomattox FPU 45,000톤 Load Out 해석

- 목적 : Load-out 시 FPU와 OFD(Offshore Floating Dock)의 구조적 안전성을 검토함.
- Load-out 진행 시 FPU의 Jack up, Jack fail, Weighing 등의 조건을 고려하였으며,
- OFD는 Initial entrance, 10%, 50%, 100% load-out, Set-down 등의 조건을 고려하여 해석을 수행함.
- Blast plan : 최적화 기법을 이용하여 각 하중 조건에 대하여 Blast plan을 계산하였음.



Load-out Plan





FE Model

Results – Stress & Displacement

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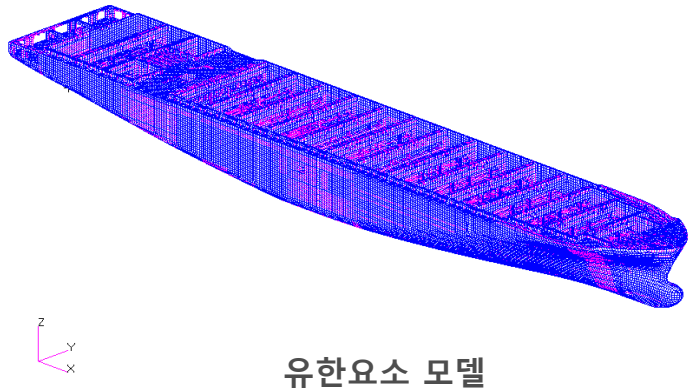
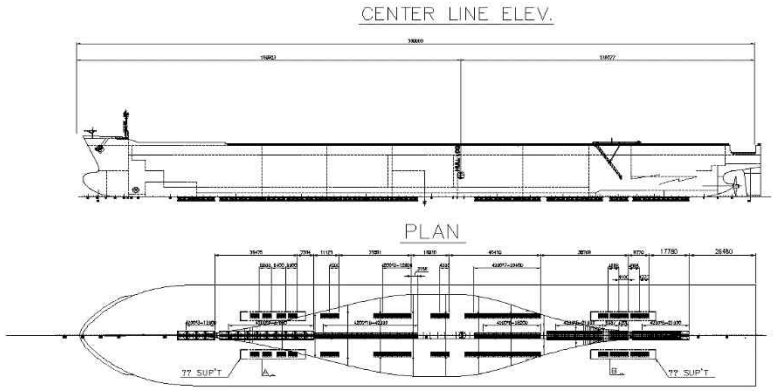
Load Out 해석 - 8,800 TEU CLASS CONTAINER CARRIER

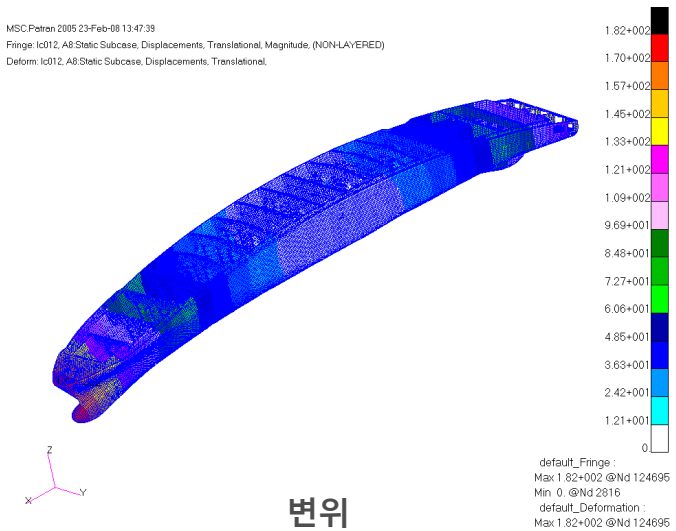
- 8,800 TEU CLASS CONTAINER CARRIER의 LOAD OUT 시 구조적 안전성 평가.
- **Length : 300m, Total Weight : 29,830ton**



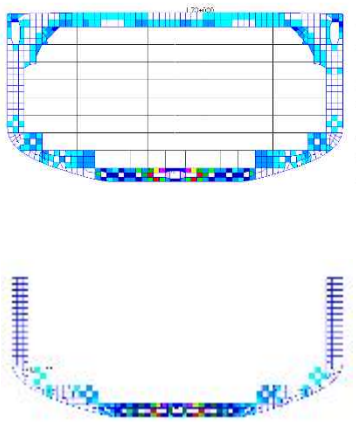
유한요소 모델

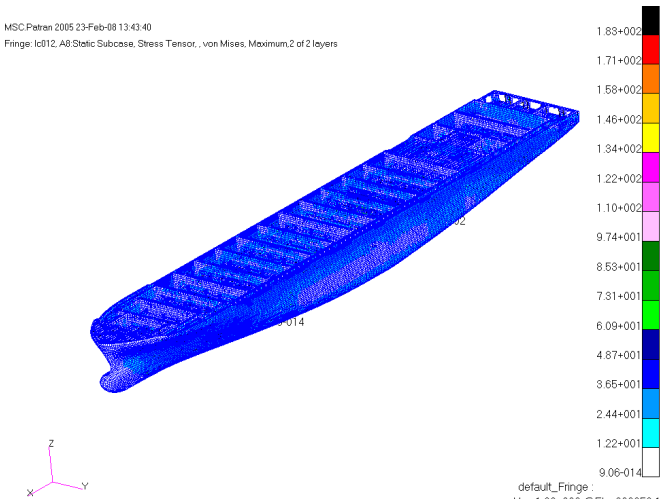


보기트레인 배치



변위

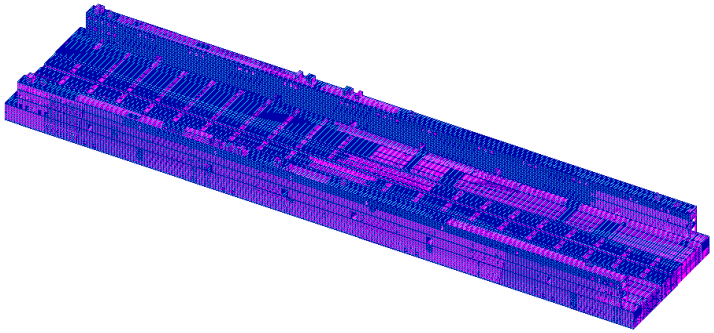




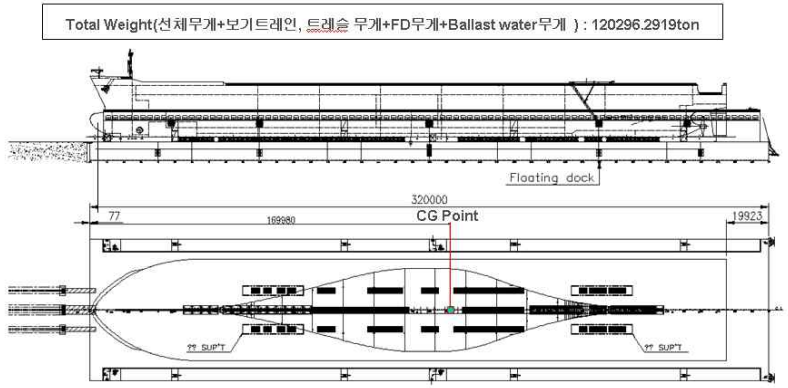
응력

Load Out 해석 - 8,800 TEU CLASS CONTAINER CARRIER

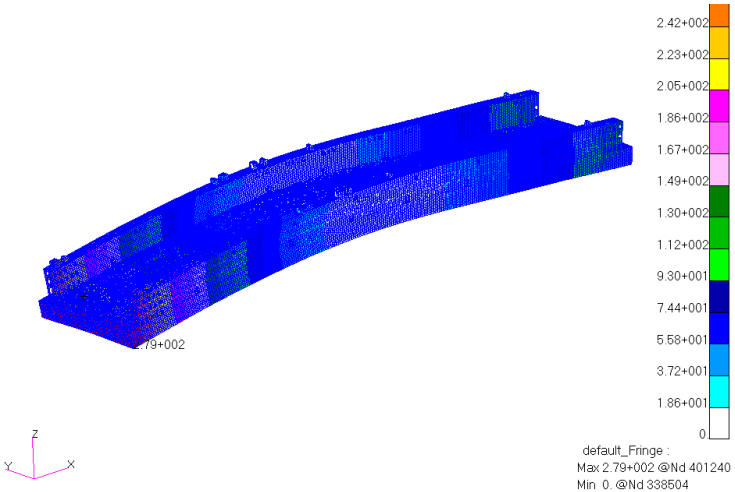
- 8,800 TEU CLASS CONTAINER CARRIER의 LOAD OUT 시 Floating Dock의 구조적 안전성 검토.
- Length : 320m, Total Weight : 120,300ton



유한요소 모델



보기트레인 배치



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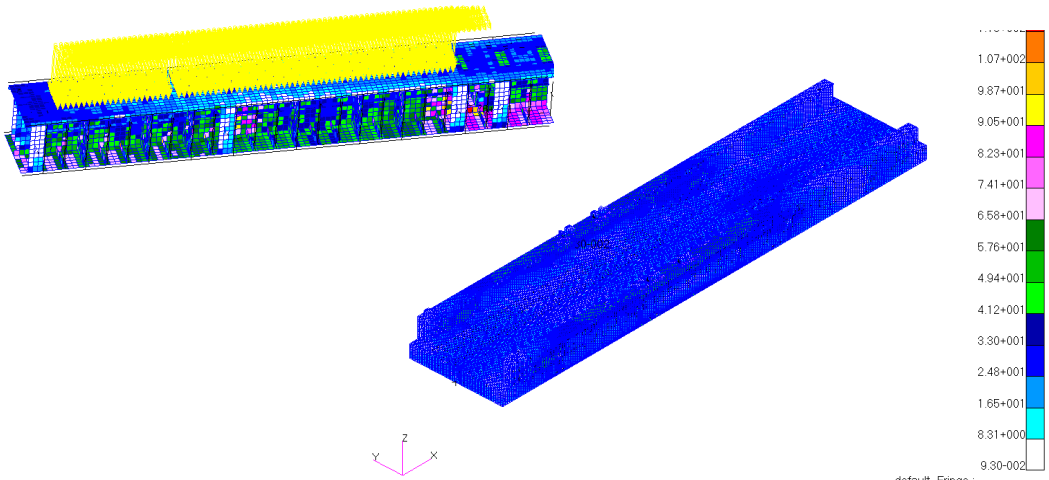
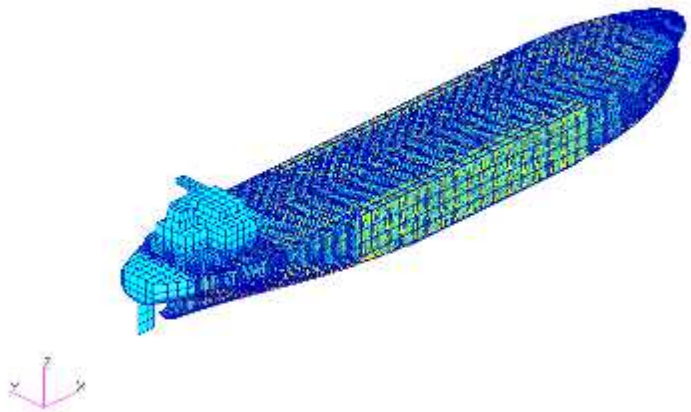


응력

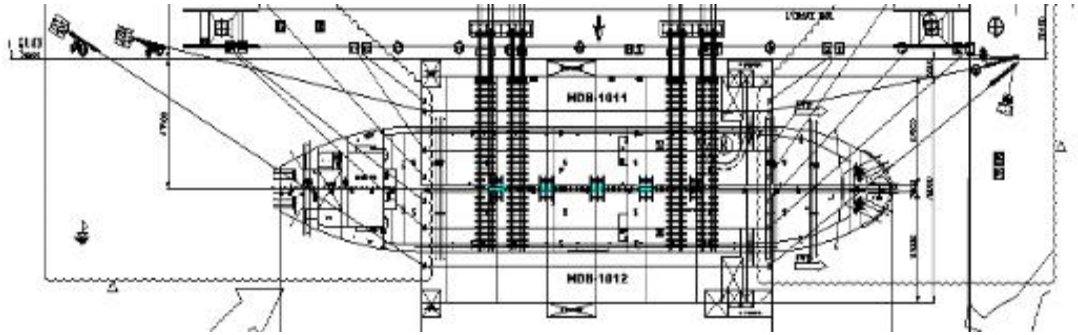
Samwon Millennia
(주)삼원밀레니어

현대 105K Load Out 해석

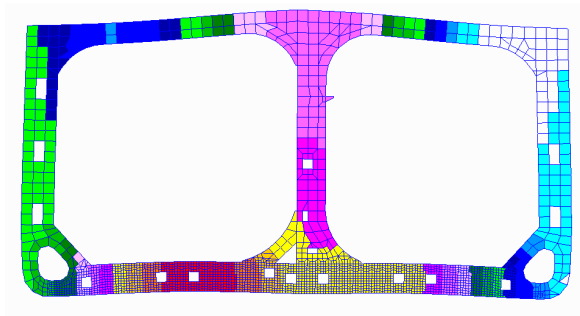
- Load Out 시 구조적 안전성 검토.



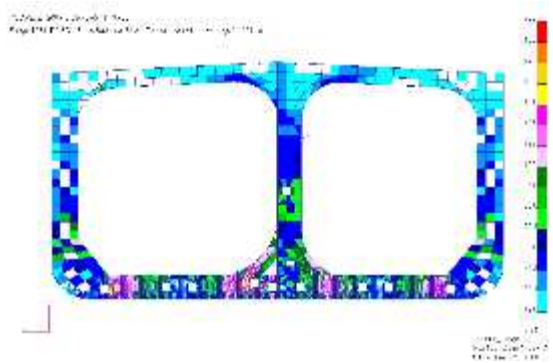
유한요소 모델 구성

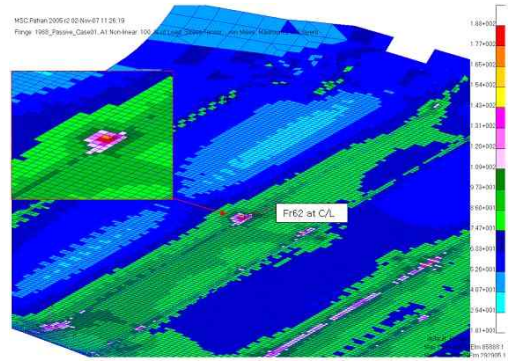


Skid Track 배치



변위

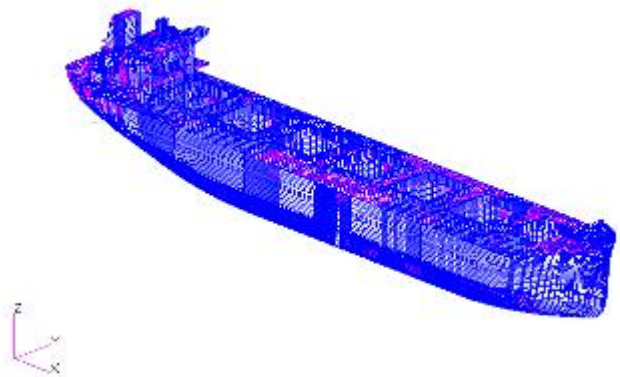




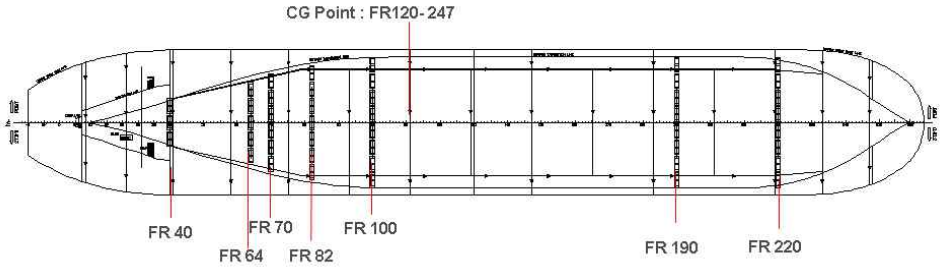
응력

93K P/C선 Lout Out 해석

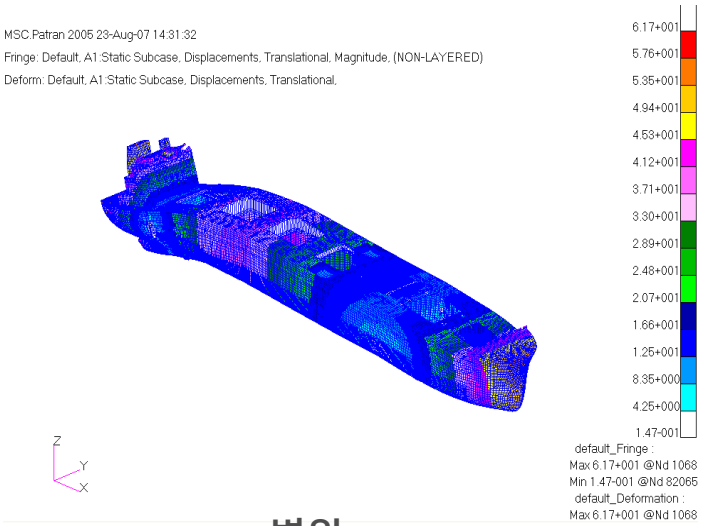
- 93K P/C선의 Side Shifting 시 구조적 안전성 검토.
- Total Weight : 15,300ton



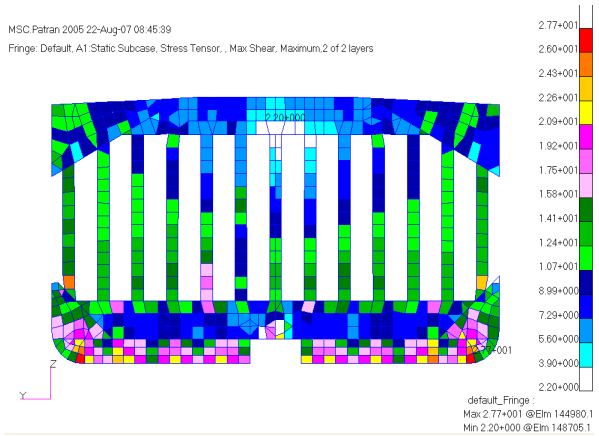
유한요소 모델 구성

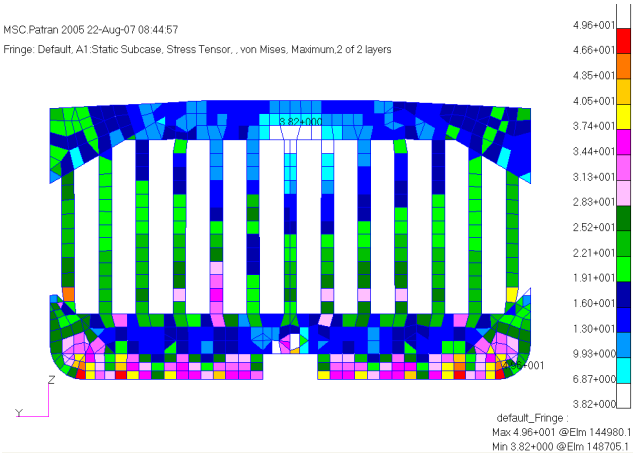


보기트레인 배치



변위





응력

Samwon Millennia
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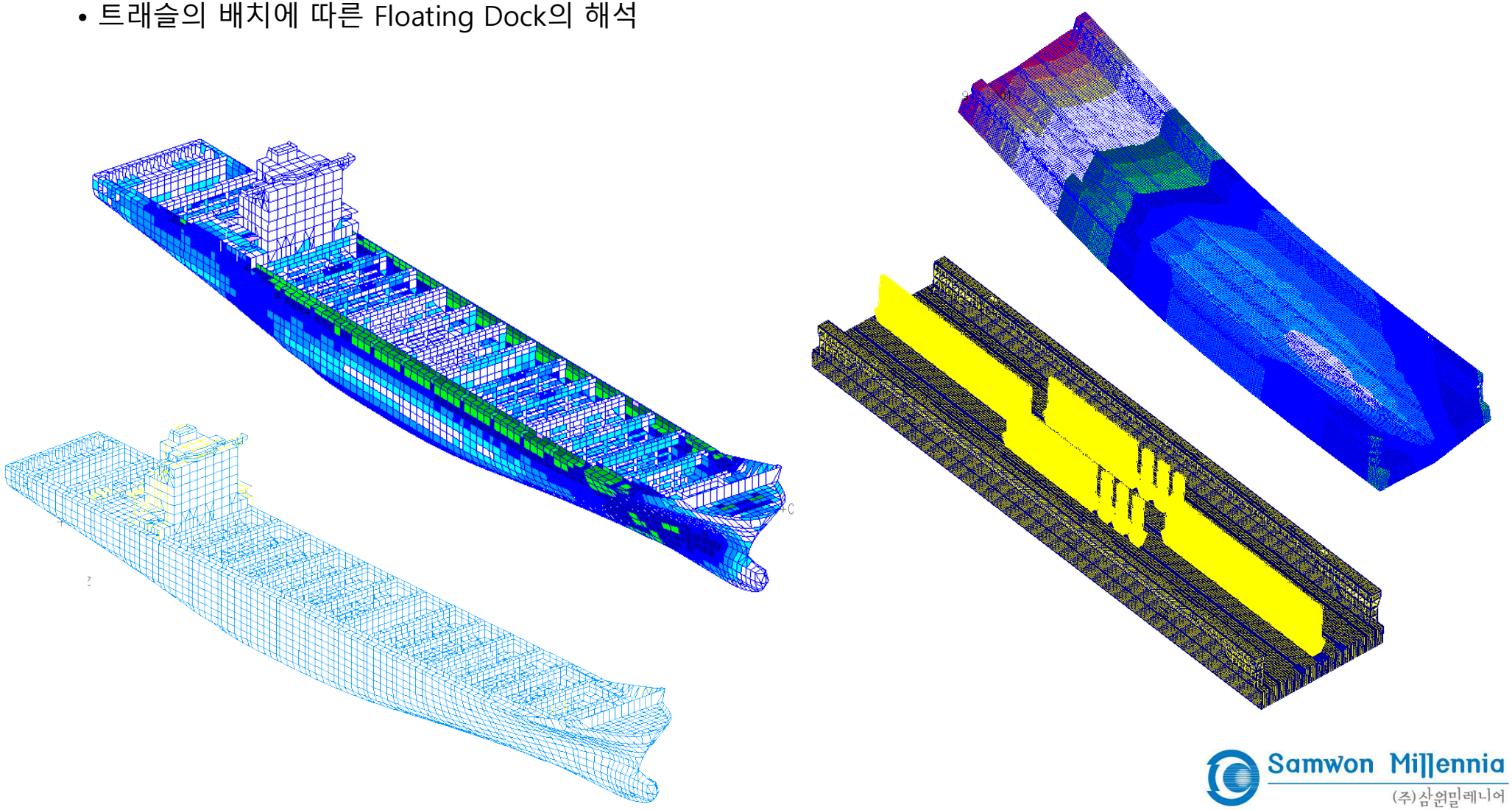
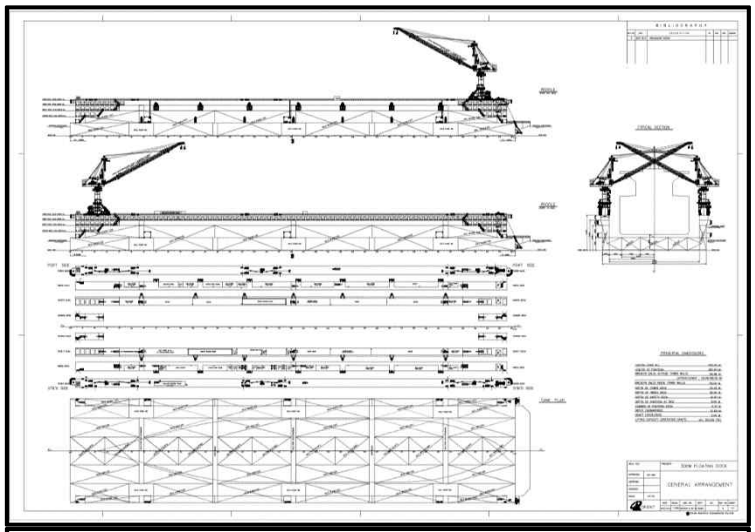
컨테이너선/ Floating Dock 변형 해석

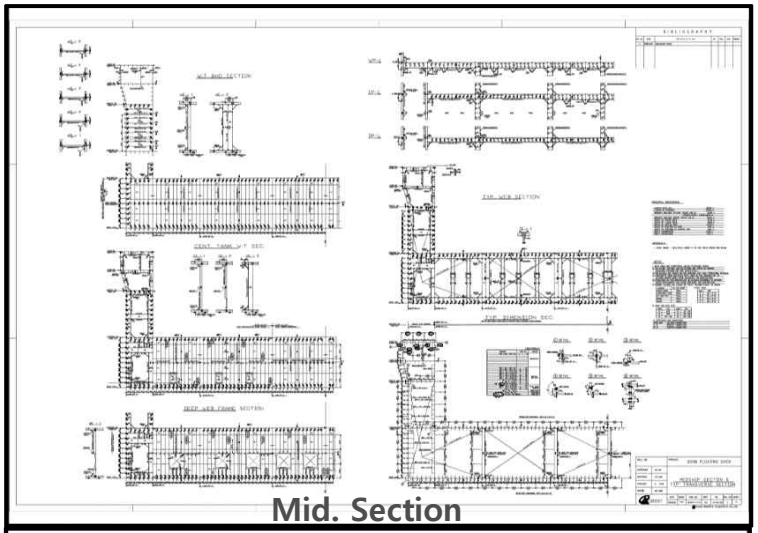
- 목 적 : Load-out 조건시 구조적 안전성 검토
- 트래슬의 배치에 따른 컨테이너 선의 처짐해석을 통해 최적의 트래슬 배치를 구하였다.
- 트래슬의 배치에 따른 Floating Dock의 해석



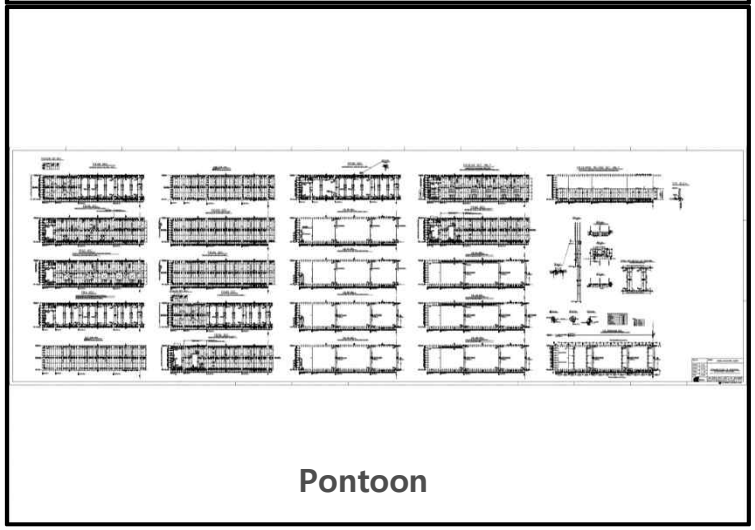
300M Floating Dock 설계

- 300m Floating Dock 설계 및 구조적 안전성 검토(해석).

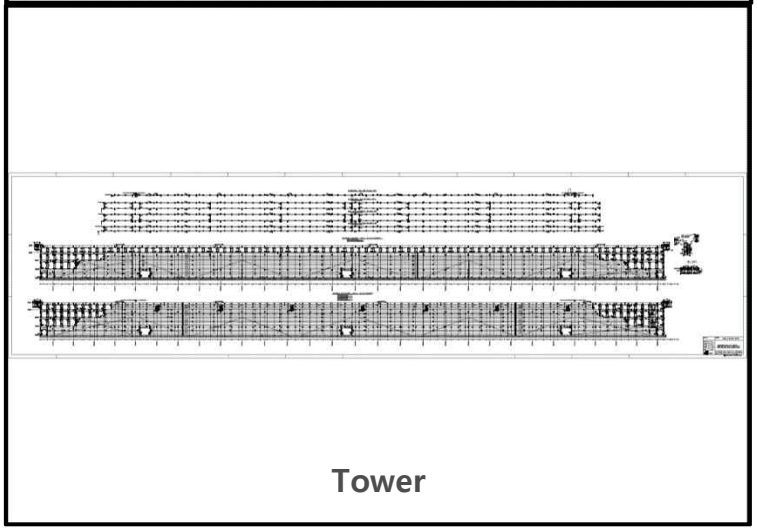




Mid. Section



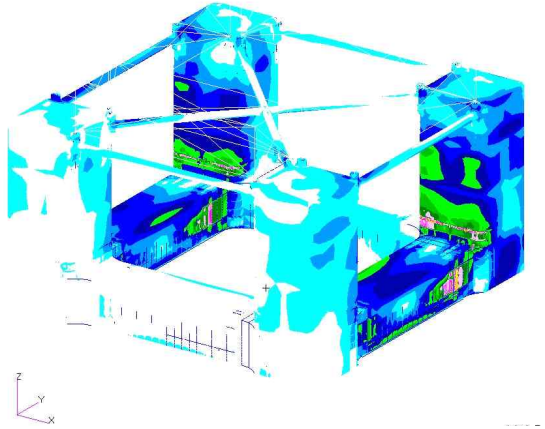
Pontoon

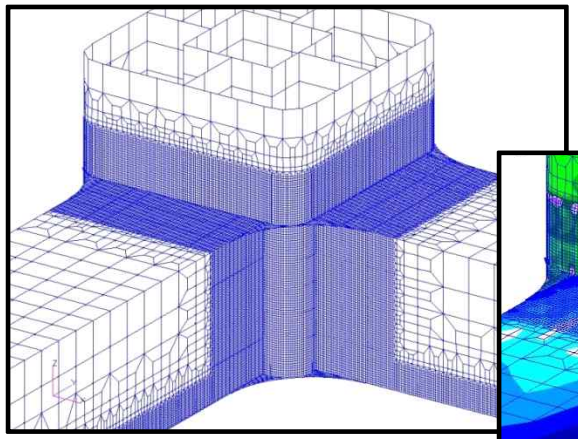


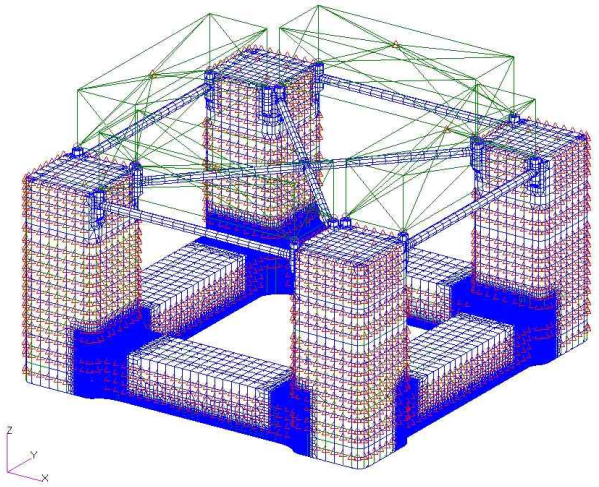
Tower

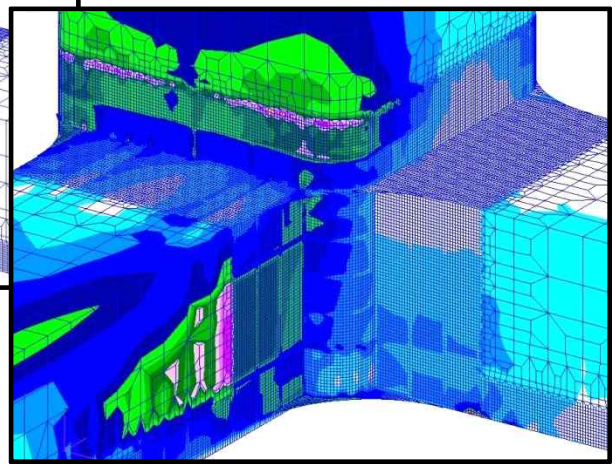
NA KIKA FPU 운송 구조 해석

- 목 적 : 운송(Transportation) 시 구조물의 강도를 평가하기 위함.







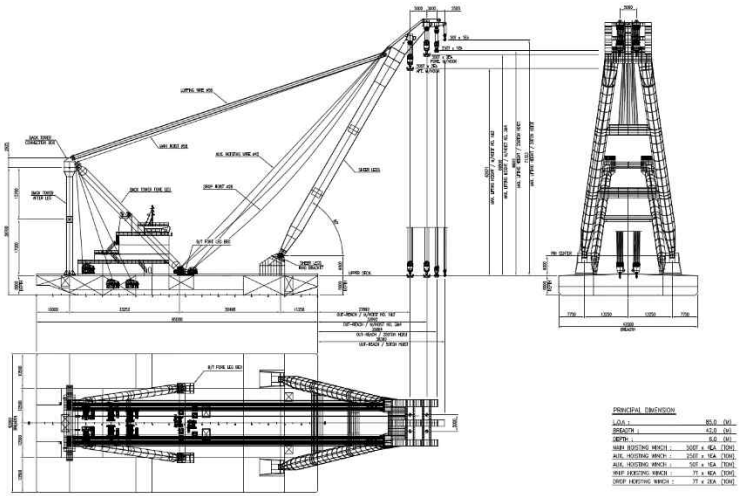


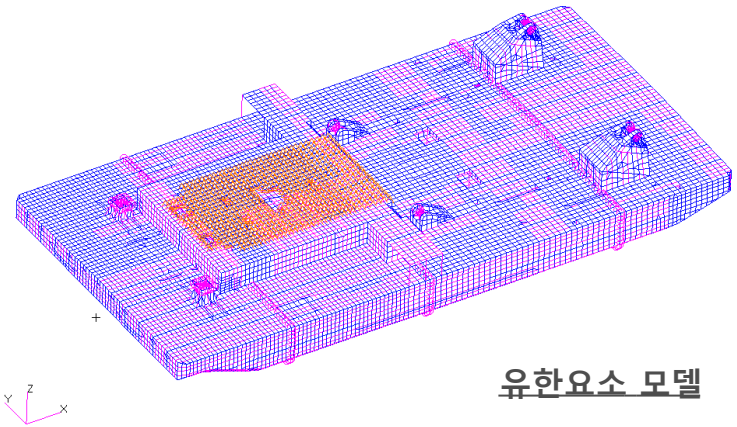
NAKIKA FPU

Stress Contour of Fine Mesh Area

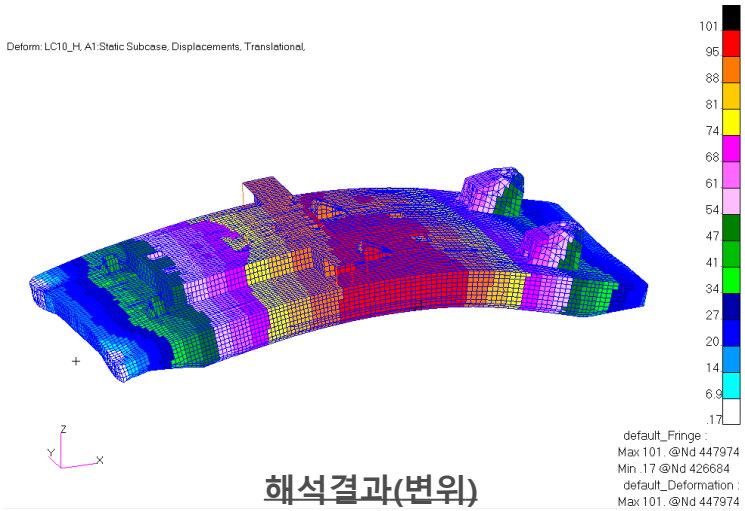
2000ton Floating Crane Barge Analysis

- 목 적 : 2000톤 Floating Crane Barge의 구조적인 안전성 검토

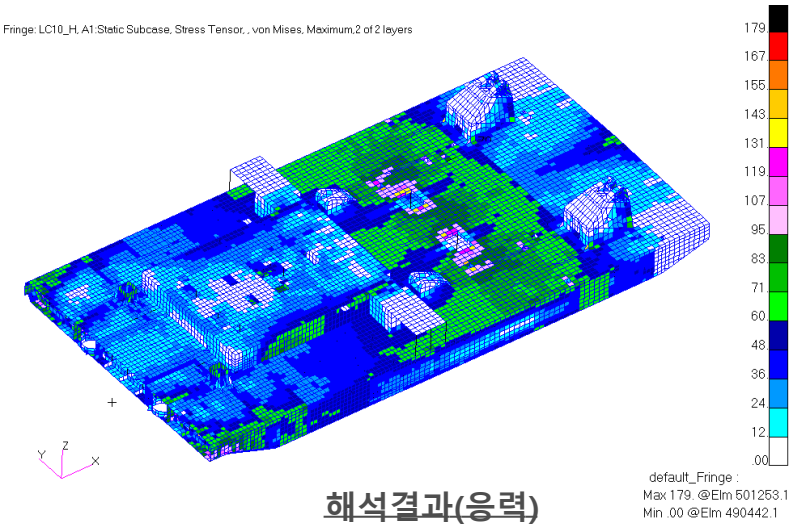




유한요소 모델



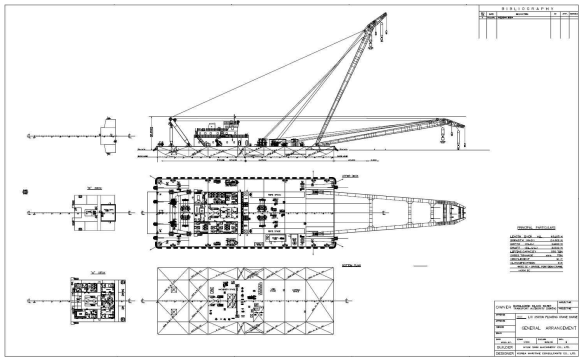
해석결과(변위)

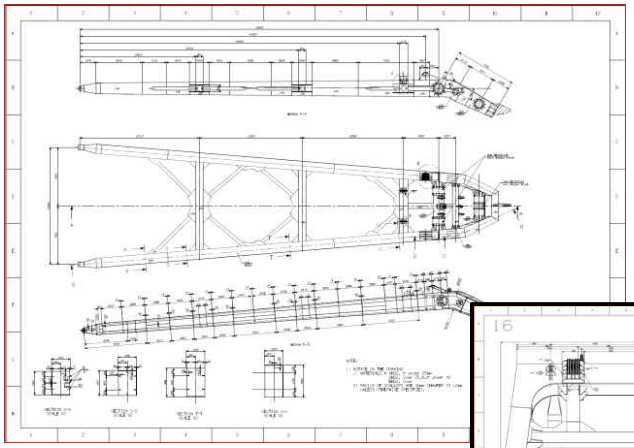


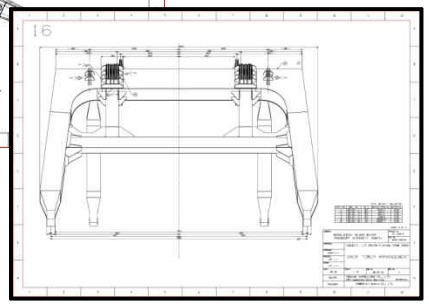
해석결과(응력)

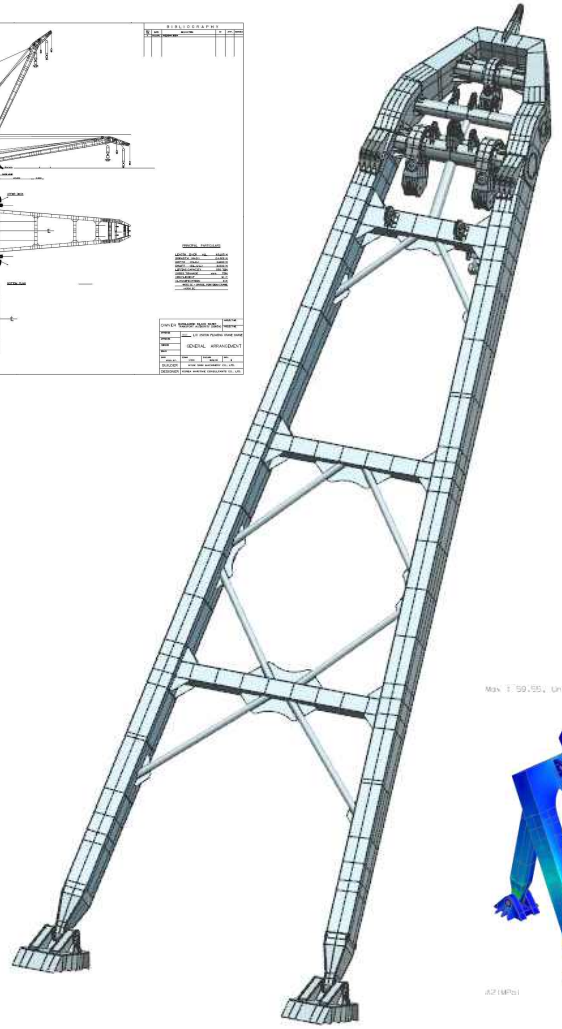
250ton Floating Crane 개발

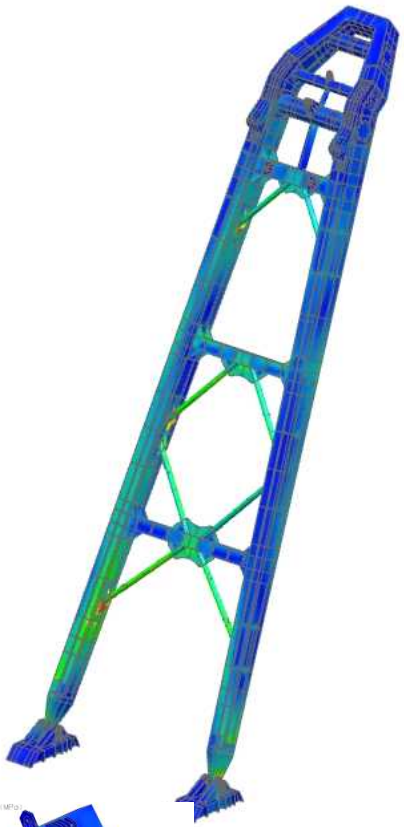
- 현재, 크레인 설계에 주로 2D 설계와 일본 도면을 카피한 설계가 주로 이루어지고 있다.
- 3차원 설계와 해석 기술, 생산을 고려하여 250ton Floating Crane 개발하였다.

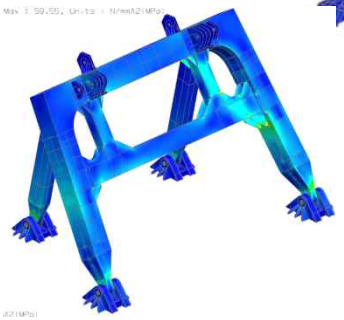












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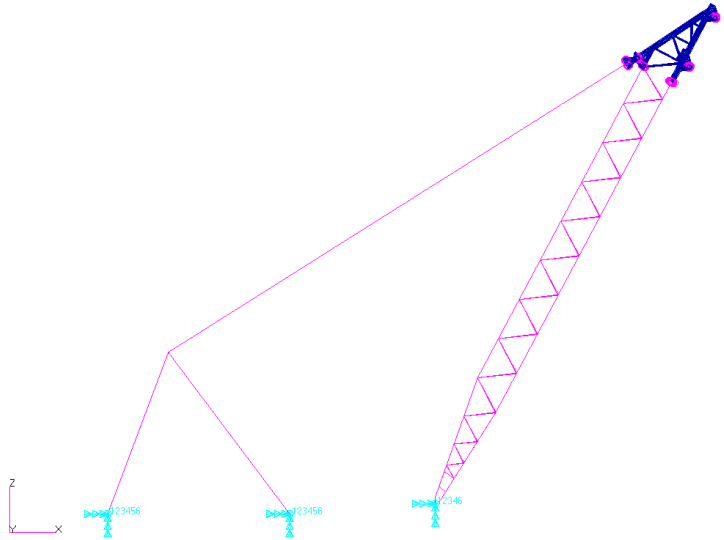
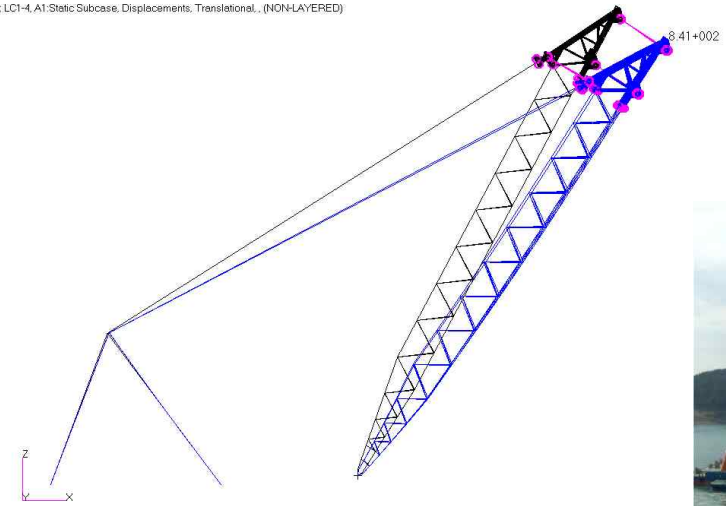
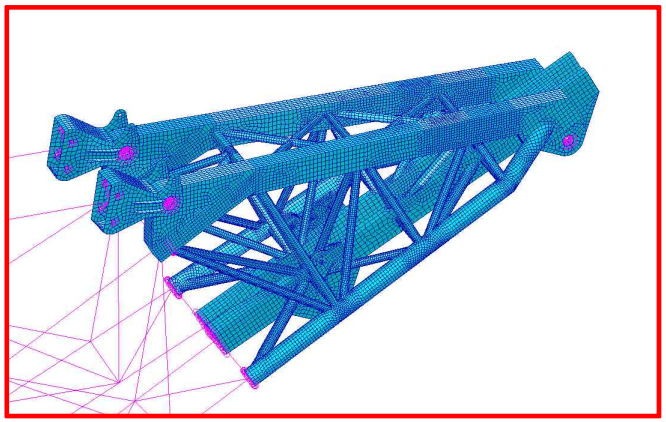
(주)삼원밀레니어

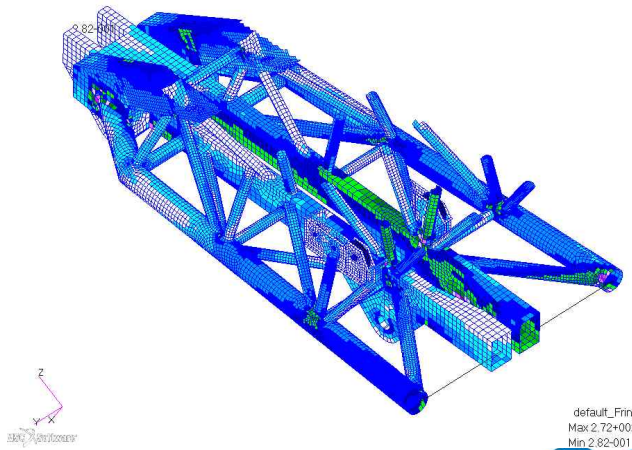
36000ton Floating Crane Load-cell Block 구조 해석

- 36000ton Floating Crane Load-cell Block의 구조적 안전성 평가.
- Load Condition : Self Weight + Wire Load + Lifting Load + Wind Load









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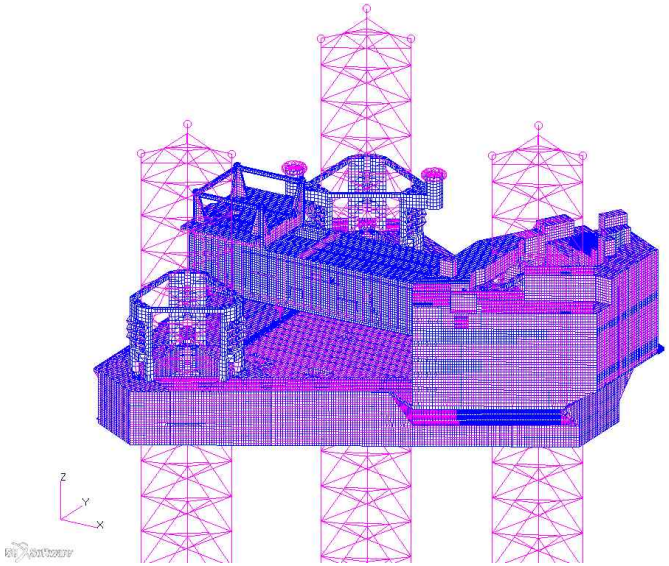
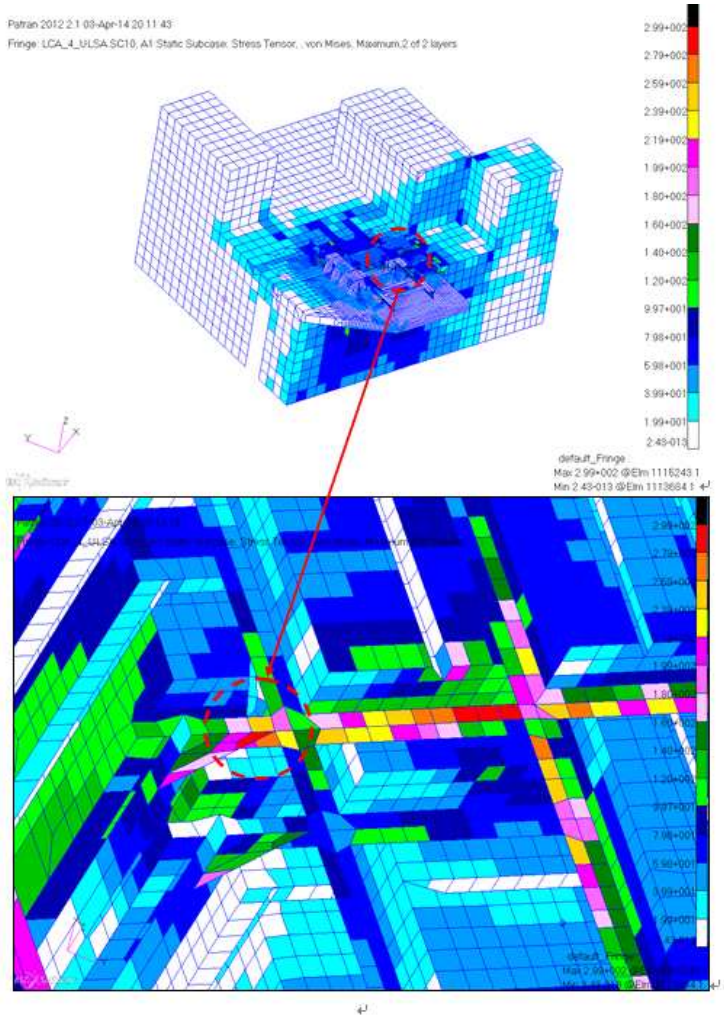
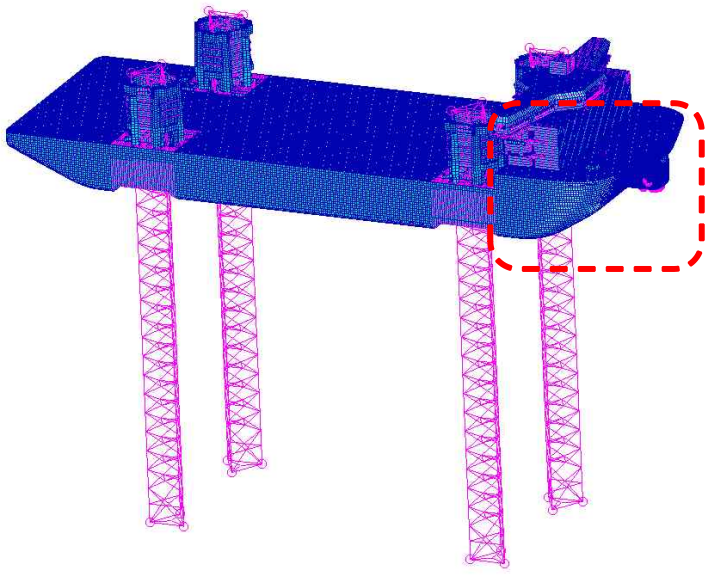
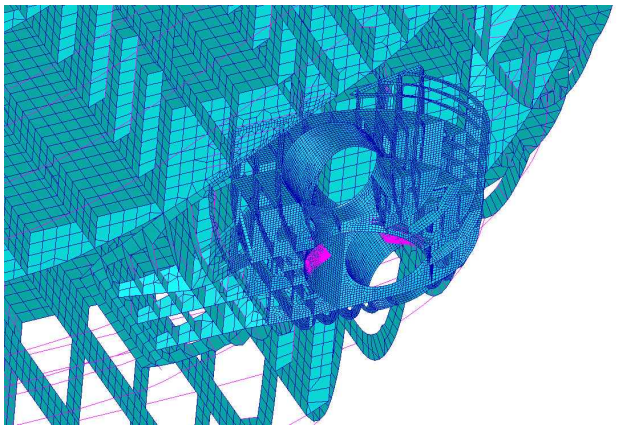
CAT-J Project Mooring 시 구조해석

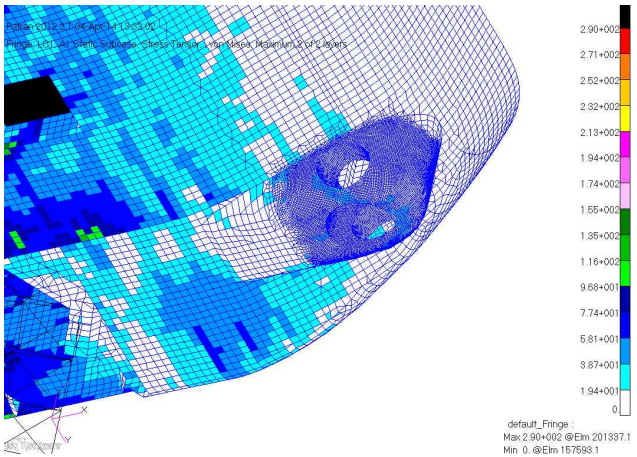


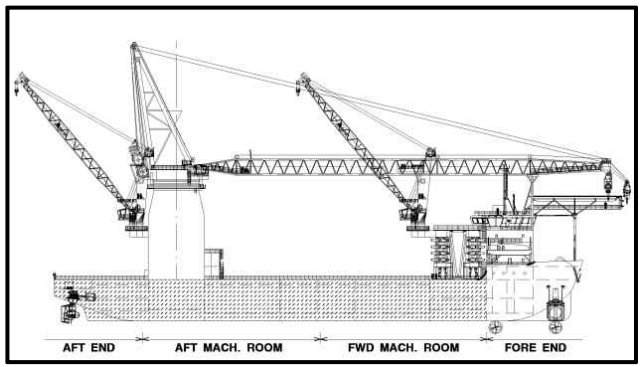


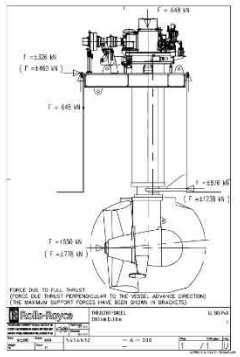
잭업 바지선 THRUSTER 구조해석





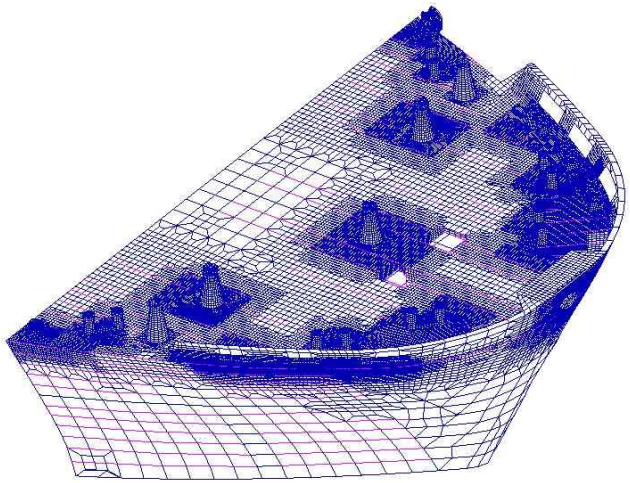


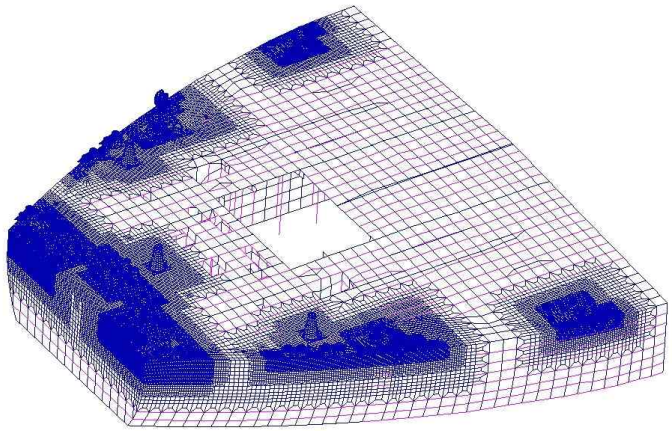




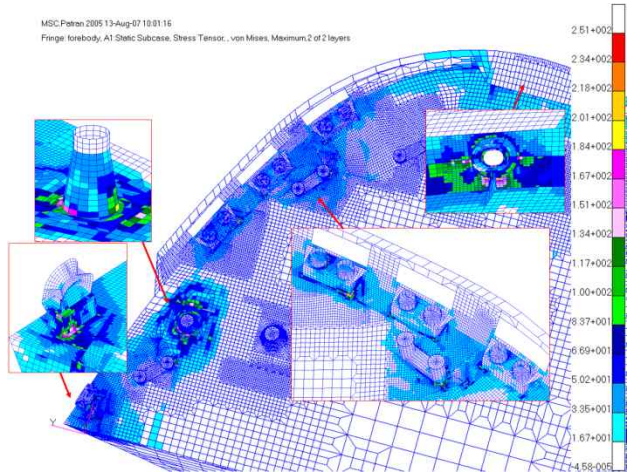
50K급 PRODUCT OIL/CHEMICAL TANKER Mooring 해석

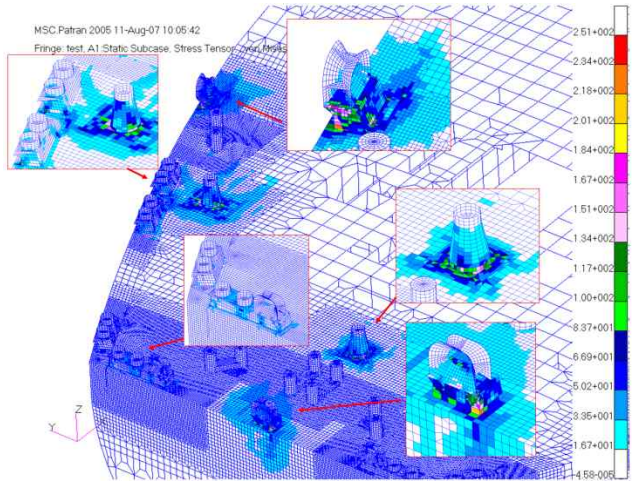
- 목 적 : 50K급 Product Oil/Chemical Tanker의 Mooring시 선체지지구조의 구조적 안전성 검토





유한요소 모델





해석 결과

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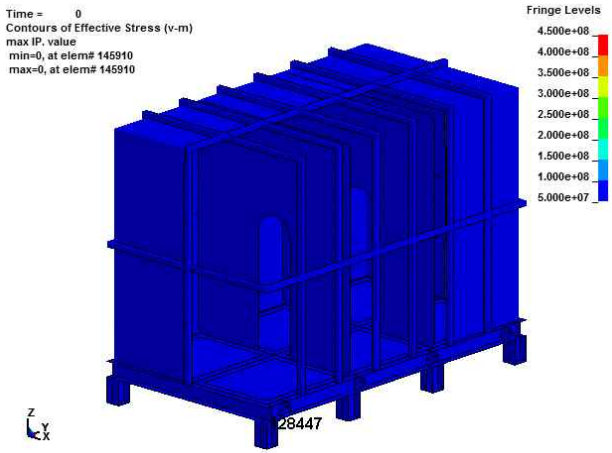
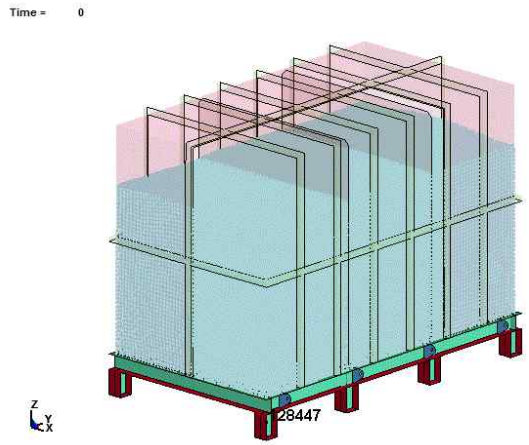
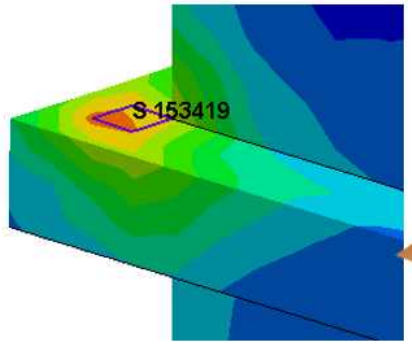
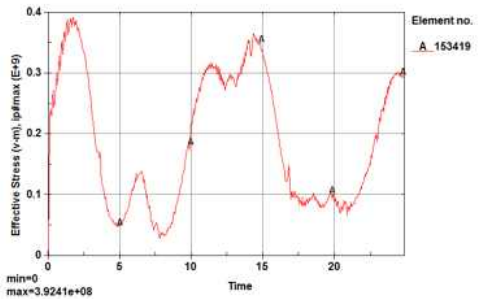
Sloshing Analysis for FPSO Foam Tank

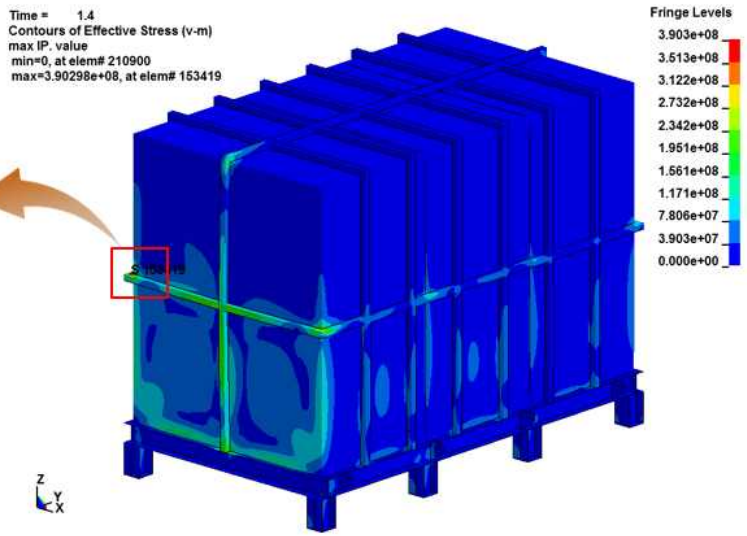
- 액화 가스의 sloshing이 저장 탱크의 구조적 안전성에 미치는 영향을 예측하기 위해 파도에 의한 탱크의 거동 조건을 부여하여 시뮬레이션을 통해 저장 탱크의 구조적 안전성을 평가하였다.











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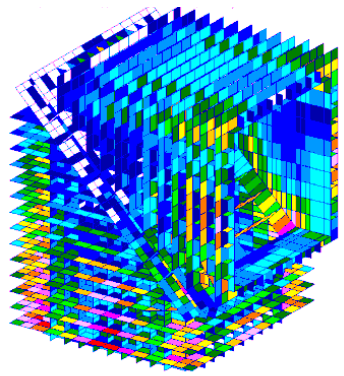
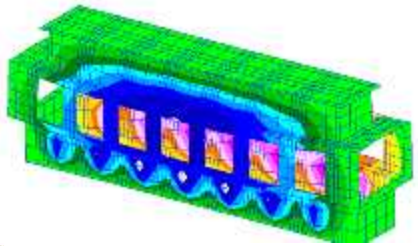
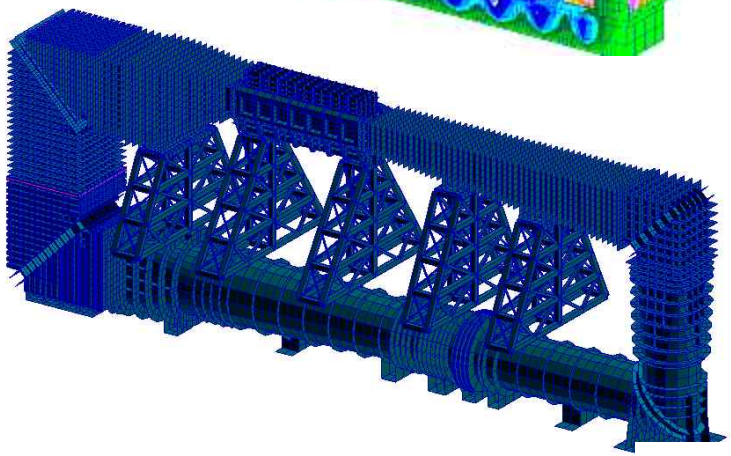
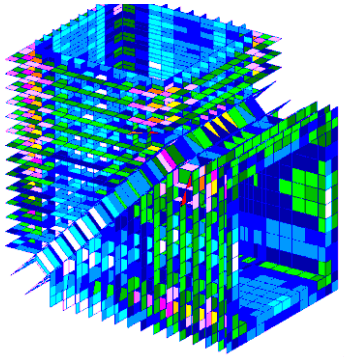
저소음 대형 Cavitation Tunnel 개발

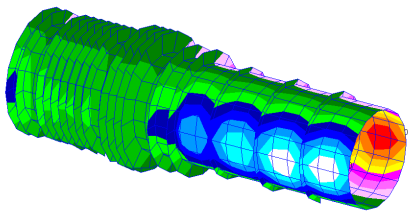
- 저소음 대형 케비테이션 터널은 상선 및 특수선의 케비테이션 및 각종 유체시험, 소음계측 및 각종 수중 음향시험에 사용되며, 선박 개발에 활용된다.
- 국내 기술로 개발된 최초의 초대형 케비테이션 터널(길이 60m, 높이 22.5m, 폭 6.5m) 이며, 선박과 함정의 성능시험이 국내서도 가능하게 되었다.

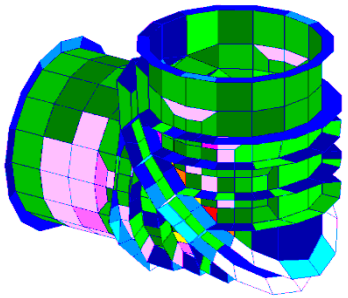


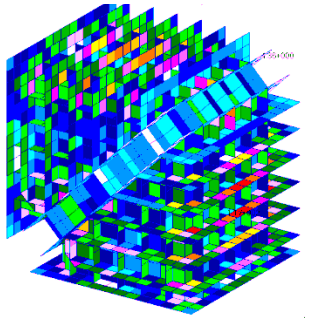












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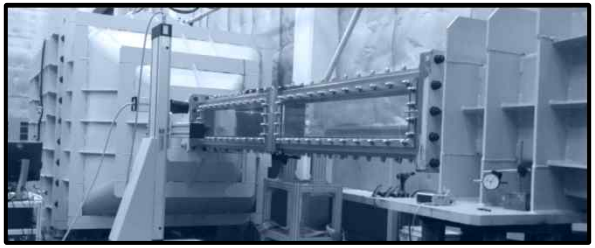
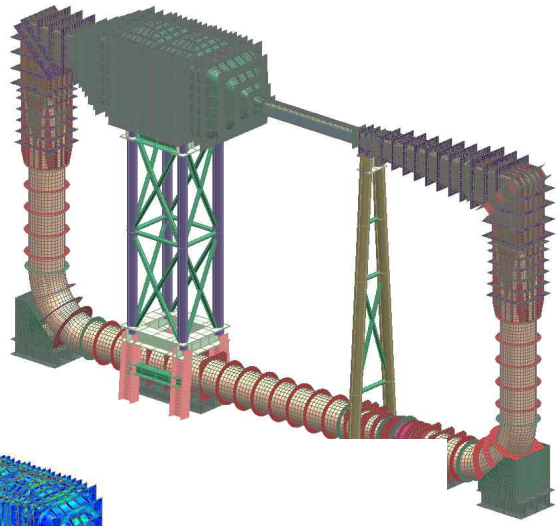
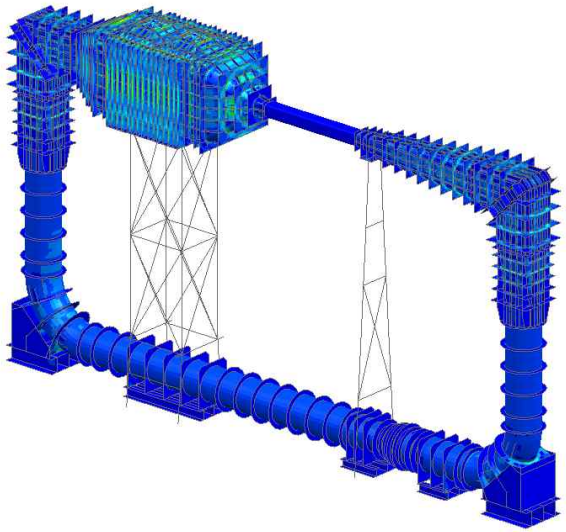
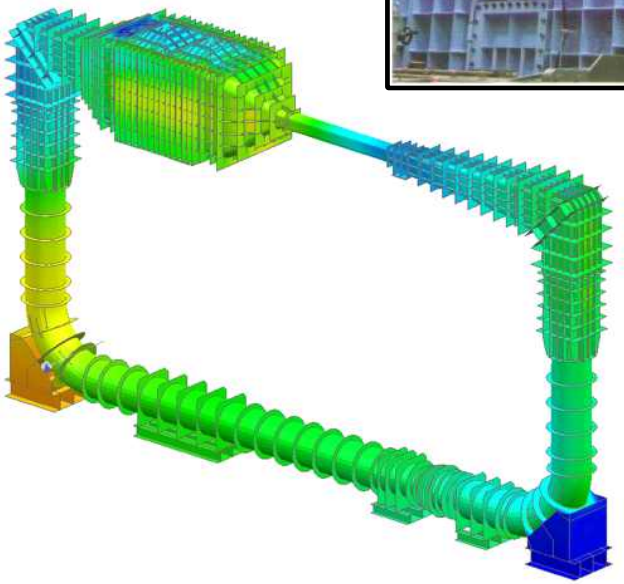
초공동 고속 캐비테이션 개발

- 초공동 고속 캐비테이션 터널의 구조적 안전성 검토 및 구조 개선 방안 마련하기 위함.
- 길이 16.5m, 높이 10m, 폭 2.26m









감 사 합 니 다.

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