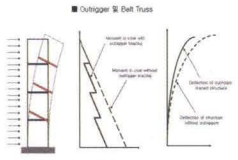
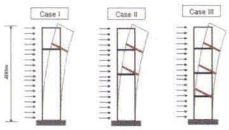
은 상 | 이현상, 임금희, 정윤영_ 경희대 | 초고층 건물에서 벨트 트런스와 아웃거리의 효과적인 변위제어를 위한 유한요소해석

초고층 건물에서 벨트트러스와 아웃리거의 효과적인 변위제어를 위한 유한요소해석

■ Outrigger 및 Belt Truss



[Outrigger의 효과]



□ 변위 : 1.08m □ 변위 : 1.02m □ 변위 : 0.97m

1/370 = NG 1/392 = NG 1/412 = OK

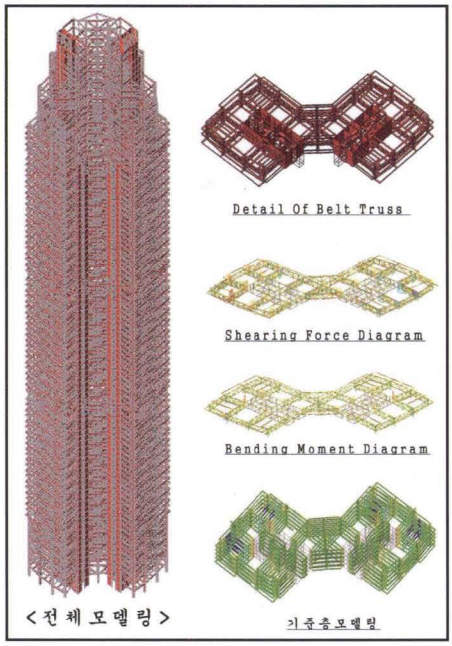
▶ DL+LL+WX (하중조합)에 의한 Belt Truss 필요 계수

고유치 해석(Eigenvalue Analysis)

Mode	UX	UY	UZ	RX
Mode No	Frequency (rad/sec)	Frequency (cycle/sec)	Period (sec)	Tolerance
1	0.770002	0.122591	8.157640	1.8710e-010
2	0.937912	0.149277	6.699855	0.0000e+000
3	1.191643	0.189565	5.520591	4.1957e-010
4	1.469462	0.192162	1.810997	0.0000e+000
5	5.476049	0.553025	1.807570	2.8400e-010
6	5.446772	0.860861	1.152591	1.1851e-010
7	6.669915	1.050410	0.951427	5.0144e-010
8	7.100058	1.140404	0.876859	6.9193e-010
9	8.091858	1.447014	0.691078	1.7193e-010
10	11.225863	1.766605	0.559105	2.0205e-010
11	12.119863	1.928843	0.518413	1.7395e-010
12	14.030859	2.233931	0.449768	6.0589e-010
13	15.491161	2.465445	0.405586	2.3887e-010
14	16.114821	2.859276	0.349851	0.0000e+000
15	18.416806	2.931084	0.341179	3.5019e-010
16	19.585868	3.104449	0.322116	4.4919e-010
17	20.420373	3.250169	0.307552	5.4469e-010
18	21.390298	3.390404	0.299891	5.4119e-010
19	23.391474	3.679594	0.272013	4.2677e-010
20	25.392471	4.059844	0.246319	8.7401e-010
21	26.404420	4.257468	0.235005	4.8114e-010
22	29.462845	4.689121	0.213258	2.8149e-010
23	31.356487	4.944218	0.202259	3.5541e-010
24	32.720592	5.213215	0.191855	6.4767e-010
25	34.380212	5.568999	0.179595	1.8517e-010
26	37.154195	6.021449	0.166072	1.5984e-010
27	39.947750	6.357879	0.157285	0.0000e+000
28	41.226663	6.561427	0.152405	1.8729e-010
29	46.013671	7.323395	0.136550	2.2605e-010
30	47.760298	7.601740	0.131548	2.2864e-011

모드참여질량(Modal Participation Masses)

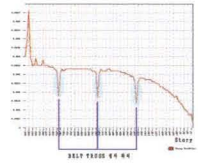
Mode	UX		UY		UZ		RX		RY		RZ	
Mode No	Trans-1 MASS	Trans-1 SUM	Trans-2 MASS	Trans-2 SUM	Trans-3 MASS	Trans-3 SUM	Rot-1 MASS	Rot-1 SUM	Rot-2 MASS	Rot-2 SUM	Rot-3 MASS	Rot-3 SUM
1	91.98	91.98	90.74	90.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	92.95	93.89	93.92	93.78	0.00	0.00	0.00	0.00	0.00	0.00	1.40	1.40
3	0.01	94.01	0.02	93.98	0.00	0.00	0.00	0.00	0.00	0.00	75.66	76.46
4	0.00	94.01	0.01	93.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.46
5	0.10	94.11	10.69	104.67	0.00	0.00	0.00	0.00	0.00	0.00	0.01	76.47
6	0.04	94.15	0.04	104.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.48
7	0.70	94.85	0.71	105.44	0.00	0.00	0.00	0.00	0.00	0.00	0.14	76.61
8	0.04	95.21	0.02	105.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.61
9	0.05	95.25	0.02	105.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.61
10	1.57	96.78	1.03	106.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.61
11	1.84	98.62	1.05	107.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.61
12	0.01	98.63	0.01	107.85	0.00	0.00	0.00	0.00	0.00	0.00	0.22	76.71
13	1.01	99.64	1.03	108.84	0.00	0.00	0.00	0.00	0.00	0.00	0.01	76.71
14	0.00	99.65	0.00	108.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
15	1.00	97.65	1.10	109.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
16	0.00	97.65	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
17	0.70	98.35	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
18	0.00	98.35	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
19	0.70	99.05	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
20	0.00	99.05	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
21	0.00	99.05	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
22	0.00	99.05	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
23	0.01	99.06	0.01	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
24	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
25	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
26	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
27	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
28	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
29	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71
30	0.00	99.06	0.00	109.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.71

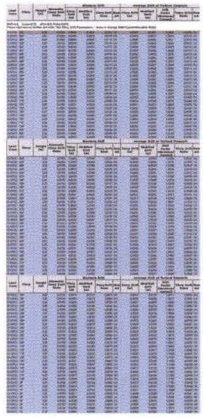


<전체 모델링>

기준층모델링

지진하중에 의한 층간변위





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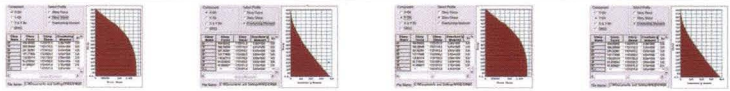

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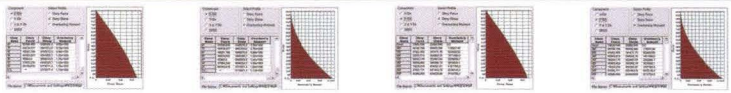
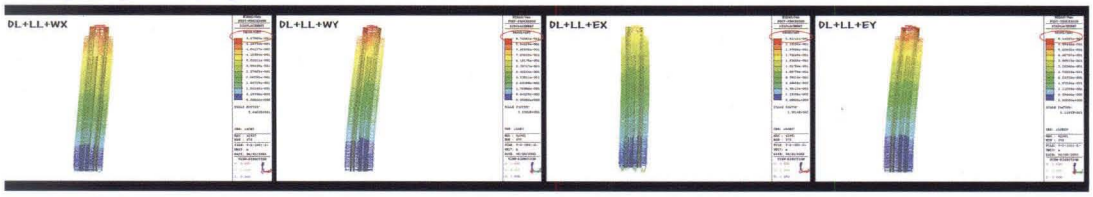
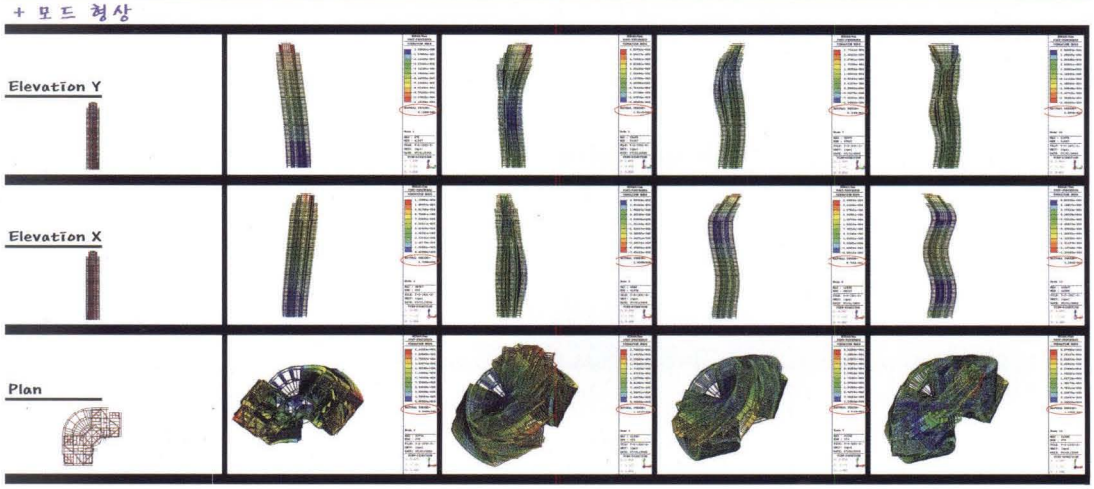


+ 벨트트러스가 세 개로 최적화된 상태

+ 하중 조합에 따른 변위

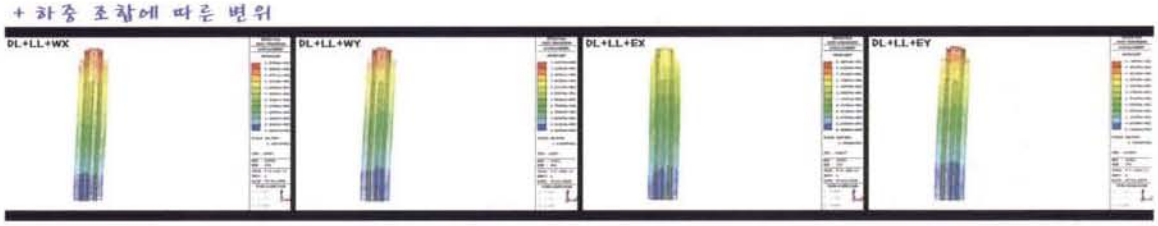


+ 모드 형상

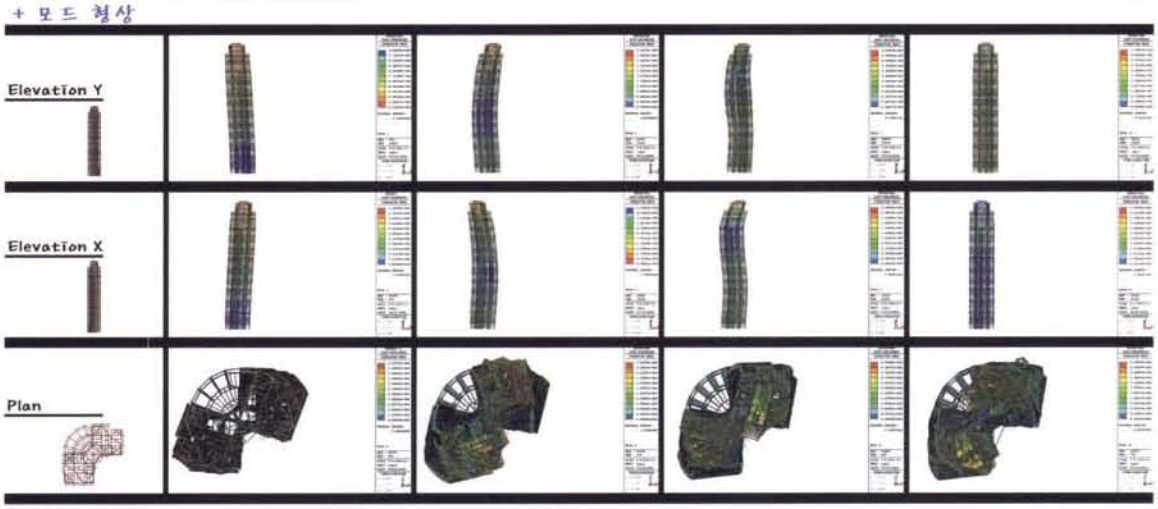


+ 상부에 벨트트러스가 두 개 있는 경우

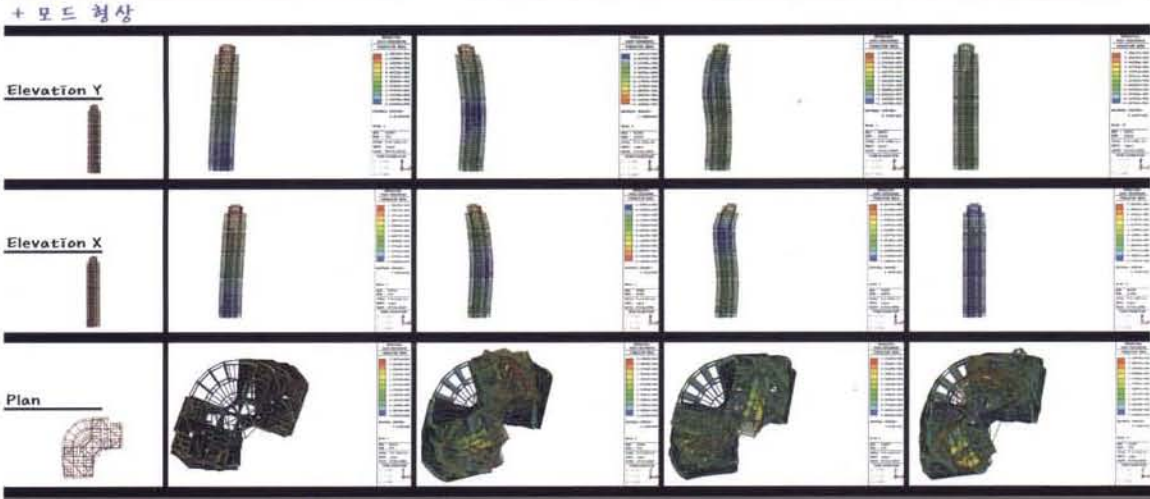
+ 하중 조합에 따른 변위



+ 모드 형상



+ 상부에 벨트트러스가 한 개 있는 경우

+ 하중 조합에 따른 변위

+ 모드 형상