
江苏丹阳19m跨度移动阳光房结构计算书

工程编号： SYS20230220527

项目名称： 哈畔移动阳光房设计项目

专业设计： 成都碧城建筑设计有限公司

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江苏丹阳19m阳光房计算书

1 工程简介

江苏丹阳19m阳光房如图1，纵向长55m，最大刚架跨度为19m，顶高8.5m，刚架间距约为1.51m，分小中大三跨，共有42榀刚架，刚架分为山墙面刚架和中间刚架，刚架通过屋面管，电机轨组合成稳定的结构体系。本计算书是对阳光房主体结构进行计算。结构计算软件所采用3D3S Design 2022（江苏丹阳同磊土木工程技术有限公司）

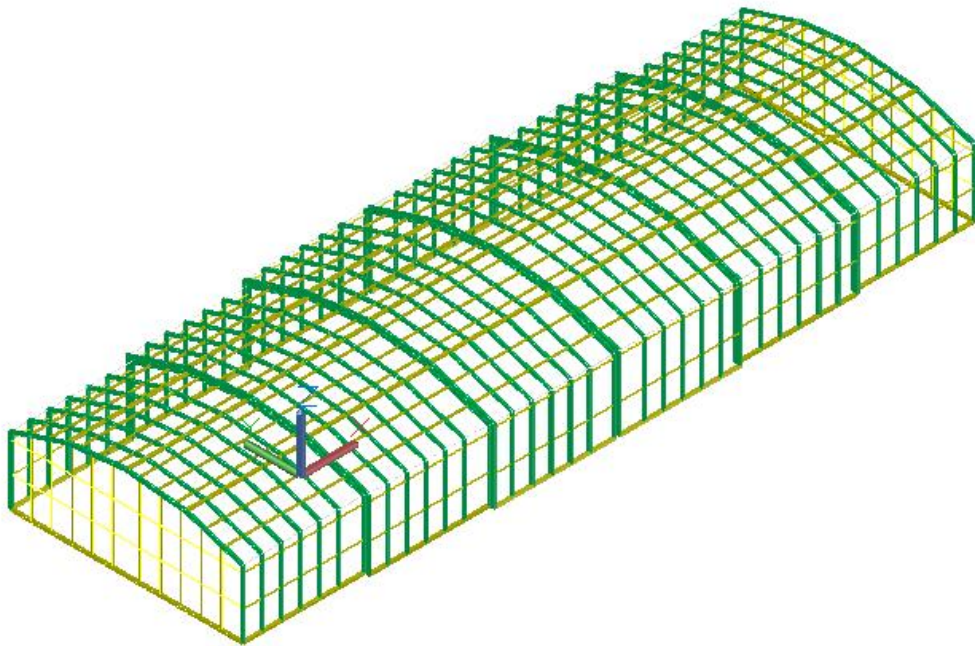


图1 阳光房结构轴侧图

2 设计依据

《铝合金结构设计规范》	(GB50429-2007)
《建筑结构荷载规范》	(GB50009-2012)
《建筑抗震设计规范》	(GB50011-2010) (2016年版)
《建筑地基基础设计规范》	(GB50007-2011)
《建筑结构可靠性设计统一标准》	(GB50068-2018)
《玻璃幕墙工程技术规范》	(JGJ102-2003)

3 计算简图

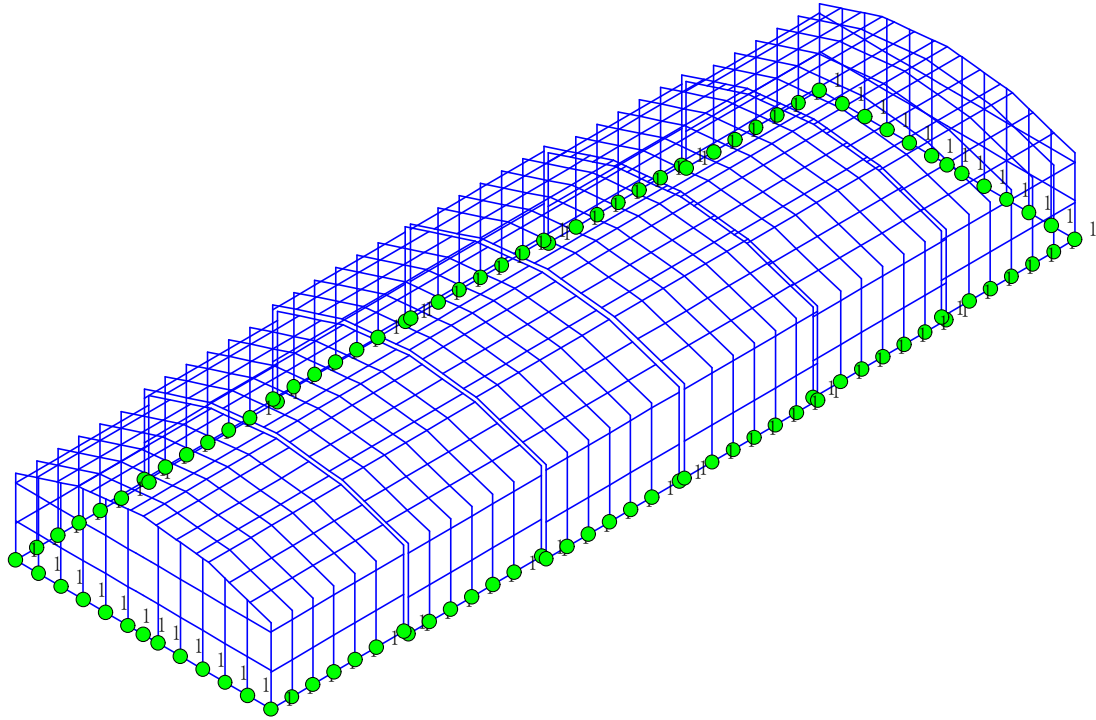


图2 江苏丹阳19m阳光房结构计算简图

4 主刚架计算模型

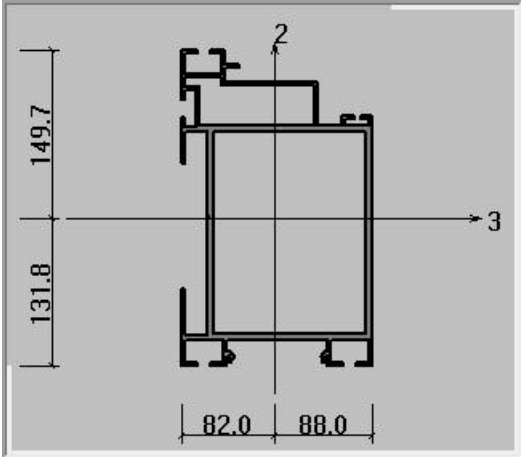
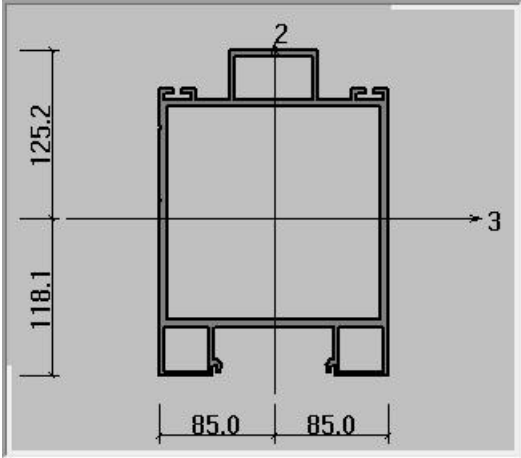
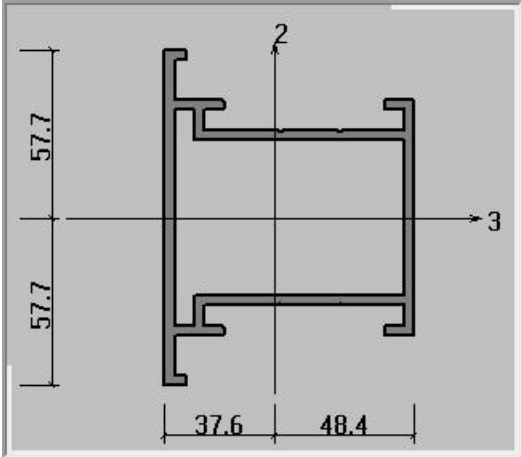
主体架构有三种材料，材料属性如表1，杆件截面如表2，单元信息表如表3.

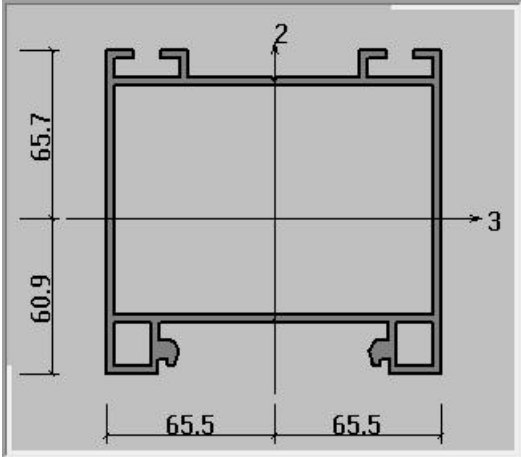
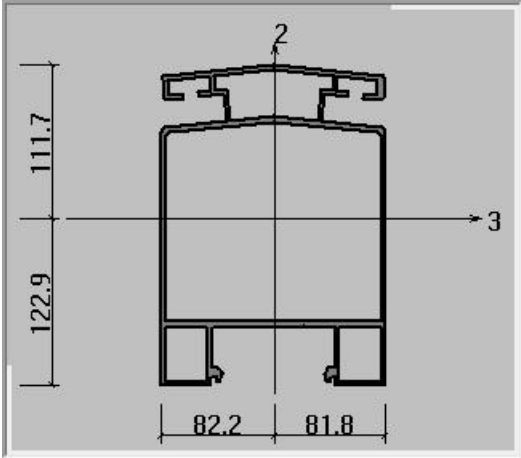
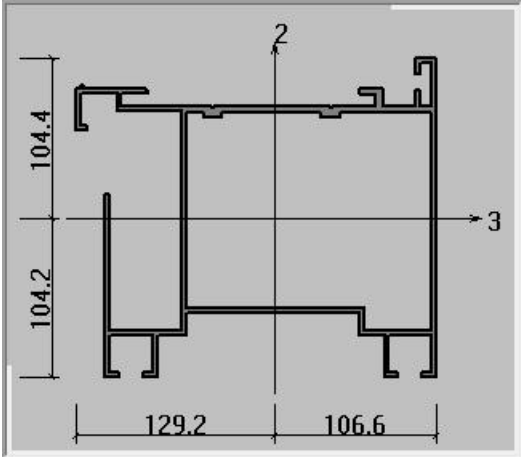
表1, 材料属性表

材料	弹性模量 (MPa)	抗拉, 抗压和抗弯f (MPa)	抗剪fv (MPa)	泊松比	密度 (kg/m ³)
铝合金 6061-T6	7e10	240	115	0.30	2700
铝合金 6063-T6	7e10	150	90	0.30	2700
铝合金 6063-T5	7e10	90	45	0.30	2700

表2, 构件截面表

序号	截面规格	材料
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1	 <p>Technical drawing of a cross-section of profile 1. The drawing shows a rectangular profile with a central cavity. The total height is 149.7, with a central section of 131.8. The total width is 170.0, divided into 82.0 and 88.0. A vertical axis labeled '2' and a horizontal axis labeled '3' are shown.</p>	<p>铝合金6061-T6 +内套3mm厚Q235B 方钢</p>
2	 <p>Technical drawing of a cross-section of profile 2. The drawing shows a rectangular profile with a central cavity and a top flange. The total height is 125.2, with a central section of 118.1. The total width is 170.0, divided into 85.0 and 85.0. A vertical axis labeled '2' and a horizontal axis labeled '3' are shown.</p>	<p>铝合金6061-T6+内 套3mm厚Q235B方钢</p>
3	 <p>Technical drawing of a cross-section of profile 3. The drawing shows a rectangular profile with a central cavity. The total height is 115.4, with two sections of 57.7. The total width is 86.0, divided into 37.6 and 48.4. A vertical axis labeled '2' and a horizontal axis labeled '3' are shown.</p>	<p>铝合金6063-T5</p>

4		铝合金6063-T5
5		铝合金6063-T5
6		铝合金6063-T5

5 荷载与组合

由于阳光房结构属于建筑，结构重要性系数取1，地形C类。

1) 恒荷载:结构自重: 由程序根据杆件截面及材料密度自动计算。

PC板自重为0.1KN/m²

2) 风荷载：取江苏丹阳地区50年一遇风载 (0.4kN/m²)

3) 雪载：取江苏丹阳地区50年一遇雪载 (0.35kN/m²)

5.1 荷载组合

(1) 1.300 恒载 + 1.50活载1

(2) 1.300 恒载 + 1.50风载2

(3) 1.300 恒载 + 1.50风载3

(4) 1.300 恒载

(5) 1.300 恒载 + 1.50活载1 + 1.50 x 0.60风载2

(6) 1.300 恒载 + 1.50活载1 + 1.50 x 0.60风载3

(7) 1.300 恒载 + 1.50 x 0.70活载1 + 1.50风载2

(8) 1.300 恒载 + 1.50 x 0.70活载1 + 1.50风载3

(9) 1.300 恒载 + 1.50 x 0.70活载1

(10) 1.300 恒载 + 1.50 x 0.60风载2

(11) 1.300 恒载 + 1.50 x 0.60风载3

(12) 1.300 恒载 + 1.50 x 0.70活载1 + 1.50 x 0.60风载2

(13) 1.300 恒载 + 1.50 x 0.70活载1 + 1.50 x 0.60风载3

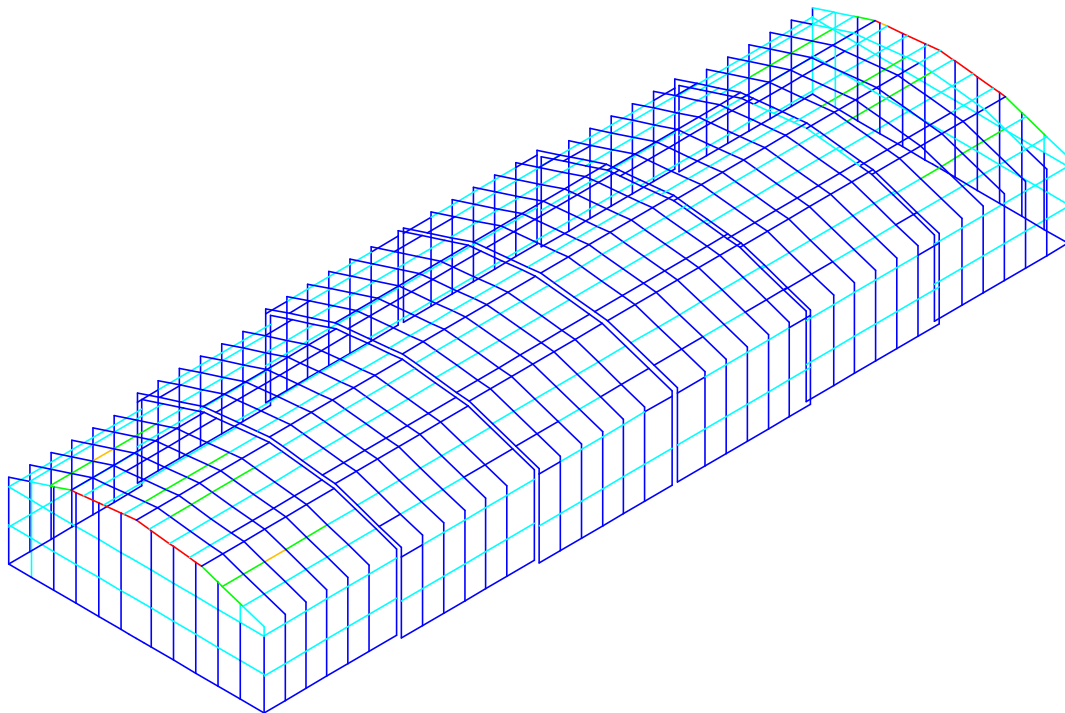
(14) 1.000 恒载 + 1.50风载2

(15) 1.000 恒载 + 1.50风载3

6 内力位移计算结果

6.1 内力

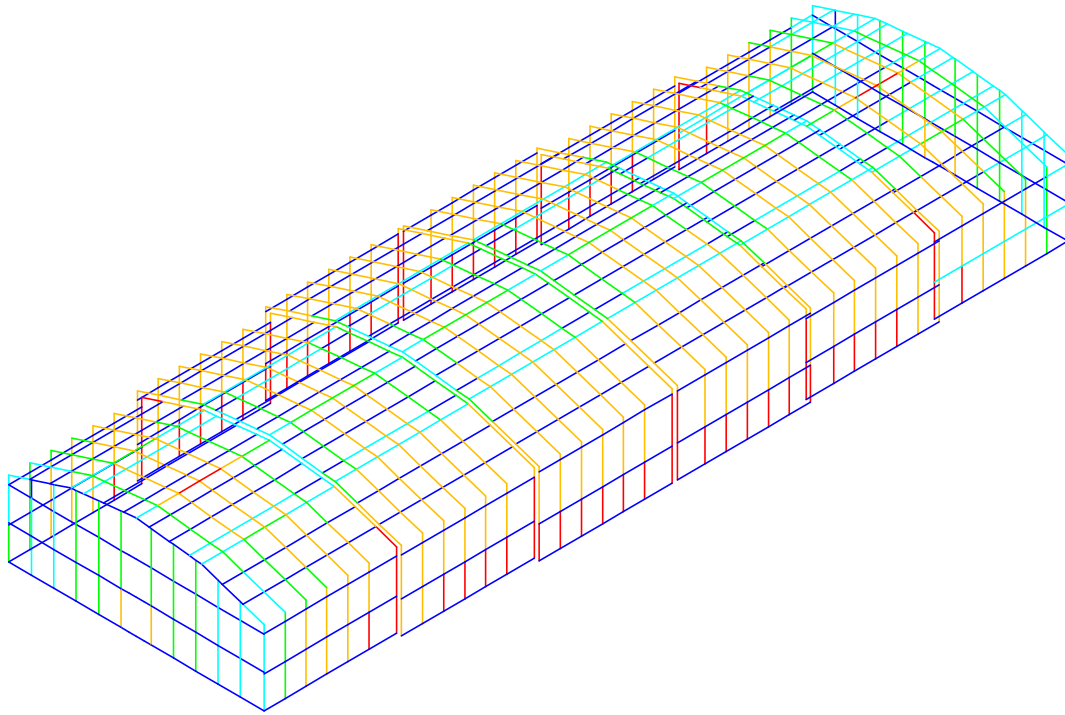
6.1.1 内力包络及统计



线性组合轴力N最大包络云图:kN (整体)

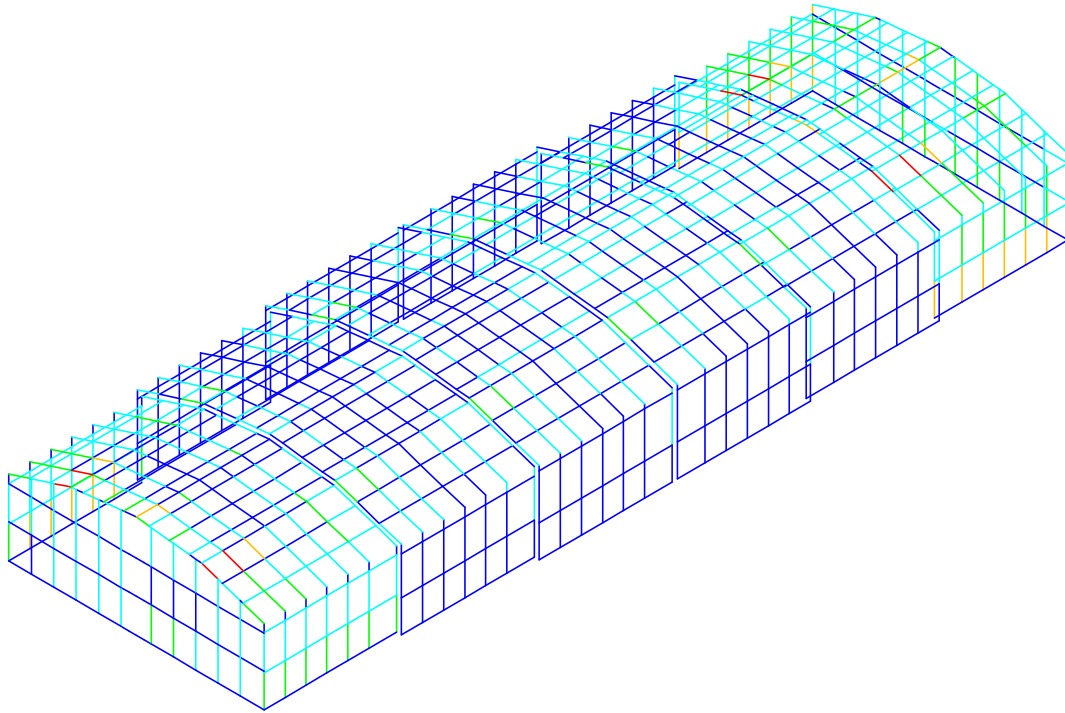
轴力N最大的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	446	8	1	0.877	12.559	2.801	-2.123	0.649	-2.072	-2.448
2	464	8	1	0.000	12.405	2.958	-2.134	-0.644	2.137	2.452
3	190	8	1	1.201	12.156	-0.870	-1.090	1.818	-0.815	0.984
4	175	8	1	0.000	12.101	-0.775	-1.035	-1.804	0.835	-0.935
5	1657	5	1	0.877	11.622	2.734	2.067	-0.732	2.018	-2.392
6	1658	5	1	0.000	11.616	2.881	1.970	0.686	-1.977	2.399
7	536	8	1	0.178	11.513	4.827	-0.421	1.564	-0.911	0.174
8	542	8	1	0.000	11.453	4.972	-0.364	-1.547	0.903	-0.308

9	979	5	1	0.000	11.364	-0.780	0.937	1.768	-0.750	-0.922
10	177	8	1	0.000	11.302	-1.800	-0.769	-3.055	0.264	-0.951



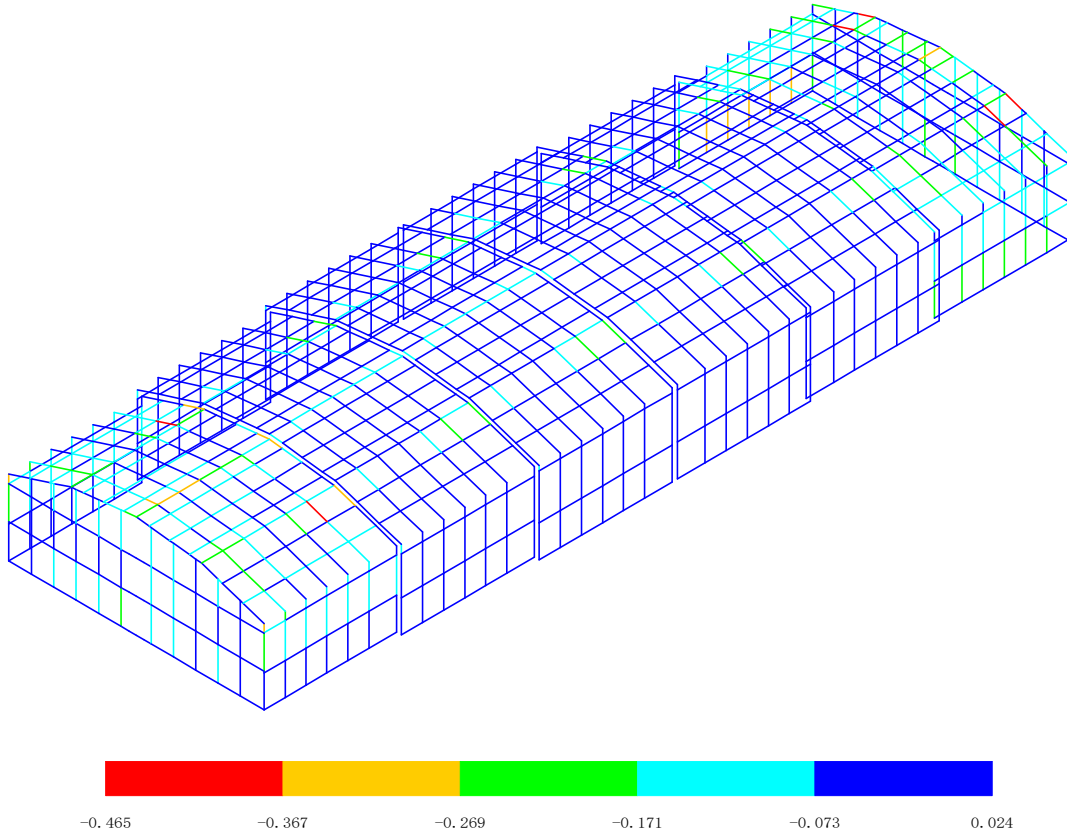
线性组合轴力N最小包络云图:kN (整体)

轴力N最小的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	1539	6	1	0.000	-16.687	10.575	-0.667	-0.783	2.019	23.794
2	1545	6	1	0.000	-16.672	-10.563	-0.666	0.779	2.014	-23.761
3	1540	6	1	0.000	-15.317	10.082	-0.570	-0.919	1.044	0.968
4	1546	6	1	0.000	-15.300	-10.068	-0.563	0.917	1.044	-0.960
5	1104	1	1	0.000	-15.189	9.703	-0.016	0.600	-0.339	22.130
6	1110	1	1	0.000	-15.175	-9.691	-0.015	-0.596	-0.338	-22.097
7	585	6	1	0.000	-14.970	-0.172	-1.049	0.000	-1.542	0.482
8	586	6	1	0.000	-14.848	-0.057	-0.470	0.000	-1.742	0.508
9	1527	6	1	0.000	-14.263	-9.940	0.101	0.030	-0.034	-24.435
10	1076	6	1	0.000	-14.263	-9.940	-0.101	-0.030	0.034	-24.435



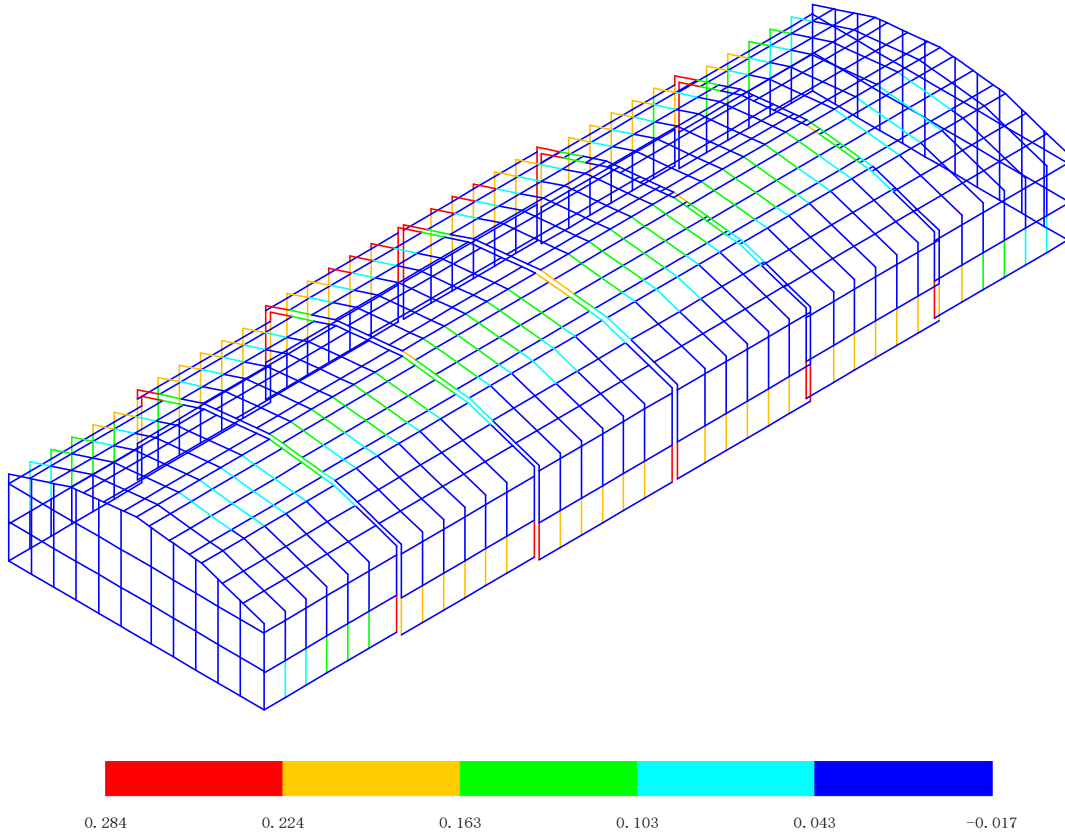
线性组合弯矩M2最大包络云图:kN.m (整体)

弯矩M2最大的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	269	6	1	0.000	-4.266	0.149	-4.688	-4.565	5.107	0.952
2	275	6	1	0.000	-4.315	-0.166	-4.695	4.497	5.081	-0.972
3	1032	6	1	0.000	-7.246	3.024	-4.387	1.193	4.785	3.357
4	1039	6	1	0.000	-7.287	-3.039	-4.376	-1.274	4.735	-3.382
5	544	6	1	0.000	5.702	-0.280	-3.561	-4.787	4.282	-0.361
6	539	6	1	0.000	5.834	0.410	-3.546	4.730	4.226	0.461
7	890	6	1	0.000	-8.354	5.295	-3.312	0.587	4.026	5.193
8	923	6	1	0.000	-8.264	-5.230	-3.295	-0.657	3.972	-5.114
9	1515	8	1	0.000	-5.799	2.342	-1.517	-1.125	3.426	4.717
10	1518	8	1	0.000	-5.798	-2.344	-1.513	1.125	3.417	-4.722



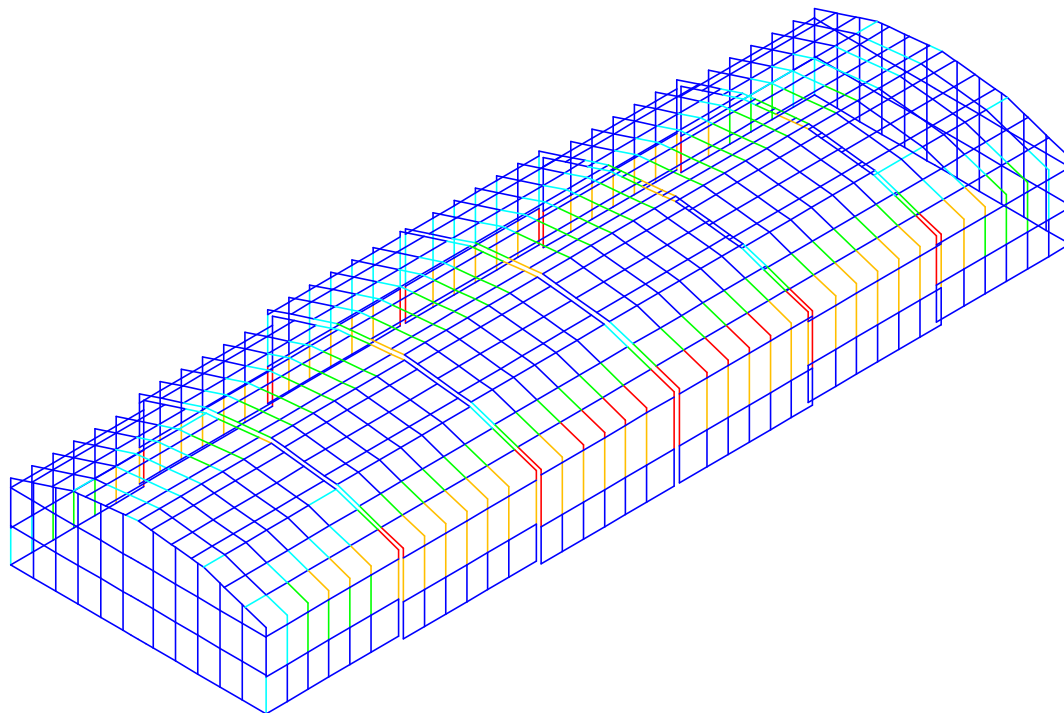
线性组合弯矩M2最小包络云图:kN.m (整体)

弯矩M2最小的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	814	5	1	0.000	-4.144	-0.169	4.255	-3.823	-4.661	-0.849
2	808	5	1	0.000	-4.175	0.052	4.073	3.849	-4.487	0.762
3	368	1	1	0.000	-8.016	2.856	4.006	-1.049	-4.205	3.129
4	374	1	1	0.000	-8.054	-2.872	3.995	1.119	-4.163	-3.154
5	1211	5	1	0.000	5.022	0.416	3.274	-4.045	-3.977	0.400
6	1216	5	1	0.000	5.640	-0.180	3.173	4.043	-3.881	-0.273
7	35	1	1	0.000	-8.718	5.039	3.161	-0.564	-3.644	4.742
8	82	1	1	0.000	-8.635	-4.981	3.146	0.627	-3.599	-4.671
9	953	6	1	0.000	-2.448	-0.644	3.506	0.002	-3.412	-0.679
10	123	6	1	1.445	-11.242	-0.368	-1.902	-0.001	-3.251	0.754



线性组合弯矩M3最大包络云图:kN.m (整体)

弯矩M3最大的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	304	6	1	1.691	-11.975	-8.390	0.382	-0.788	0.257	28.374
2	1090	6	1	0.304	-12.215	-8.809	0.382	-0.488	0.669	28.374
3	843	6	1	1.691	-11.975	-8.390	-0.382	0.788	-0.257	28.374
4	1529	6	1	0.304	-12.215	-8.809	-0.382	0.488	-0.669	28.374
5	1547	6	1	0.546	-13.679	-9.509	-1.262	1.230	-0.354	27.888
6	925	6	1	1.516	-13.088	-9.604	-1.262	0.718	-1.060	27.888
7	84	1	1	1.516	-12.696	-8.901	0.850	-0.249	0.921	26.406
8	1112	1	1	0.546	-12.889	-9.312	0.850	-0.953	-0.049	26.406
9	317	6	1	1.603	-11.632	-8.051	0.414	-0.758	0.246	26.394
10	1199	6	1	0.545	-11.775	-8.607	0.414	-0.469	0.644	26.394

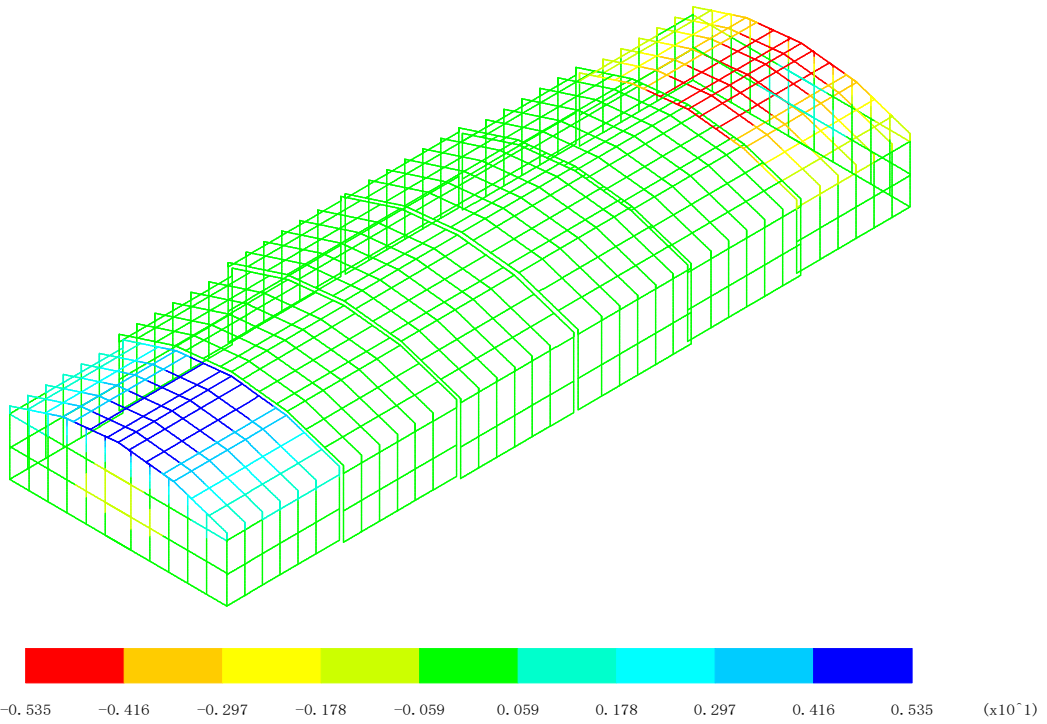


线性组合弯矩M3最小包络云图:kN.m (整体)

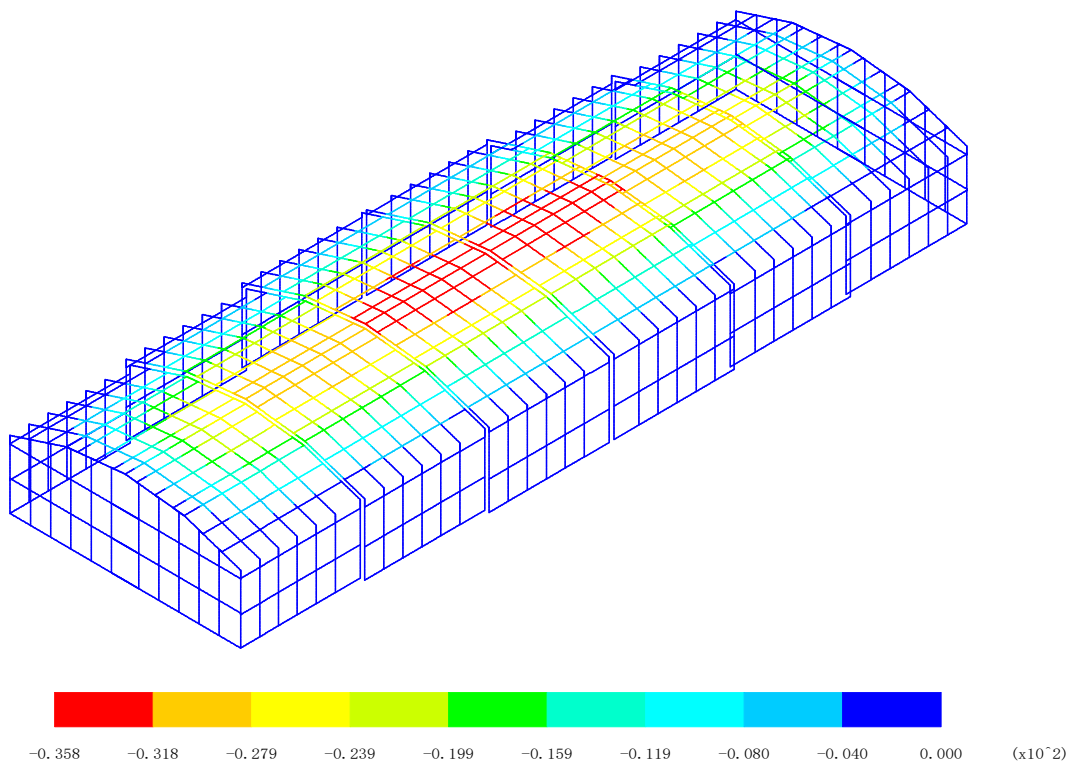
弯矩M3最小的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	291	6	1	1.673	-11.979	8.391	0.374	0.775	0.252	-28.388
2	1046	6	1	0.304	-12.204	8.823	0.374	0.479	0.659	-28.388
3	829	6	1	1.673	-11.979	8.391	-0.374	-0.775	-0.252	-28.388
4	1523	6	1	0.304	-12.204	8.823	-0.374	-0.479	-0.659	-28.388
5	892	6	1	1.499	-13.108	9.636	-1.258	-0.733	-1.049	-27.924
6	1541	6	1	0.546	-13.701	9.531	-1.258	-1.225	-0.373	-27.924
7	37	1	1	1.499	-12.713	8.929	0.849	0.260	0.915	-26.440
8	1106	1	1	0.546	-12.906	9.331	0.849	0.950	-0.035	-26.440
9	310	6	1	1.586	-11.637	8.063	0.409	0.755	0.242	-26.410
10	1194	6	1	0.545	-11.774	8.618	0.409	0.464	0.643	-26.410

6.2 位移

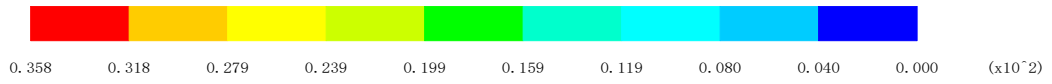
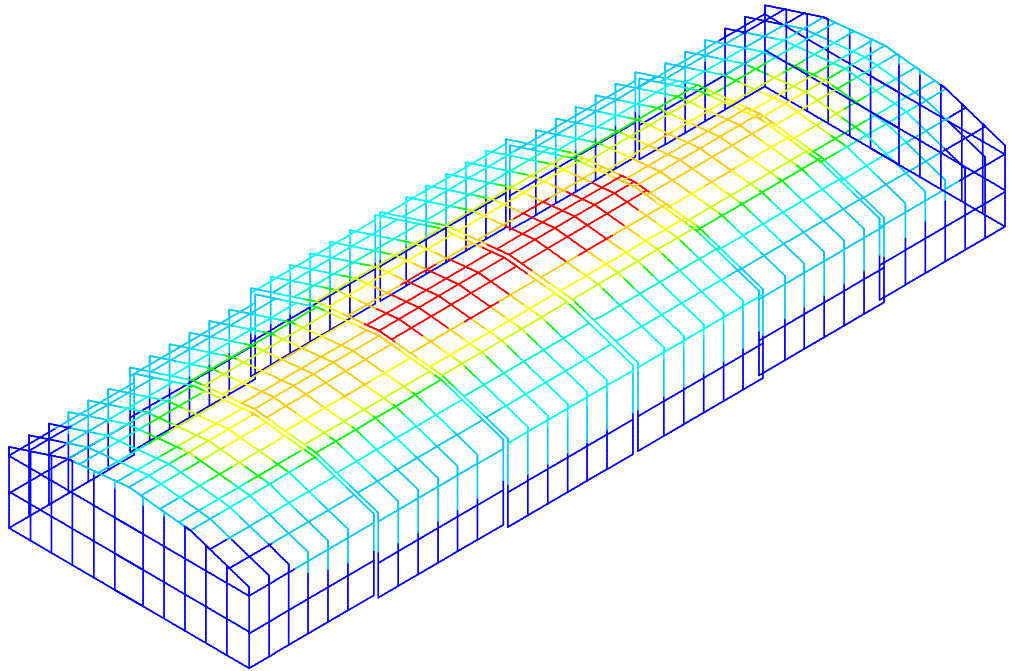
6.2.1 位移计算结果



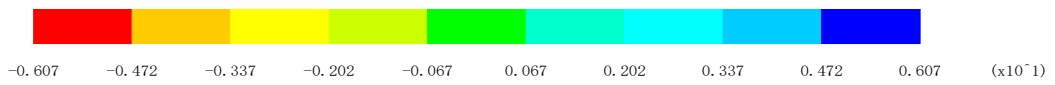
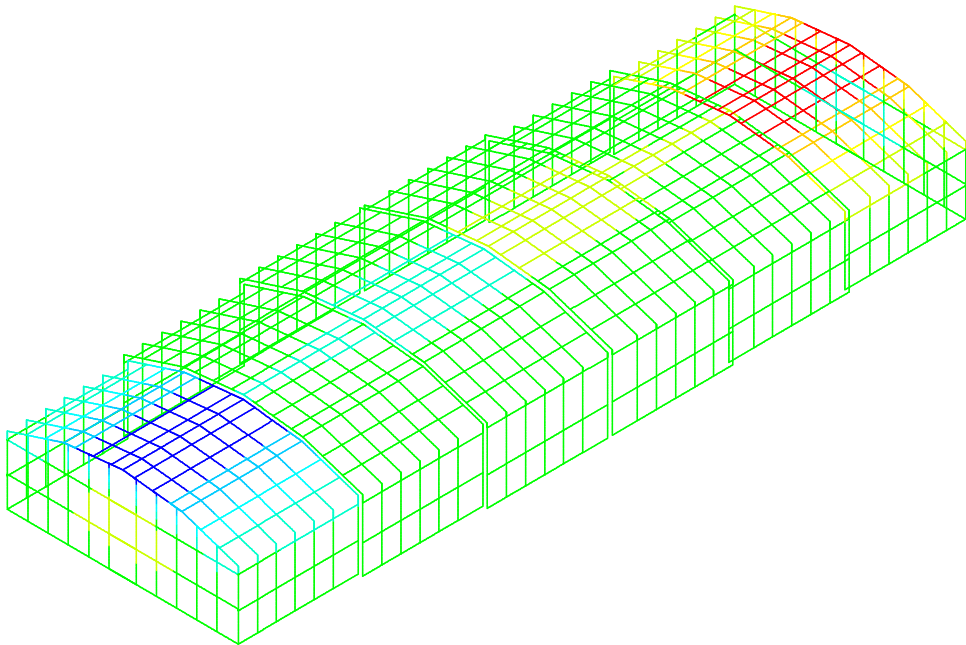
恒载工况 U_x :mm (整体)



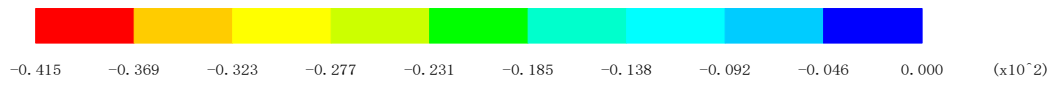
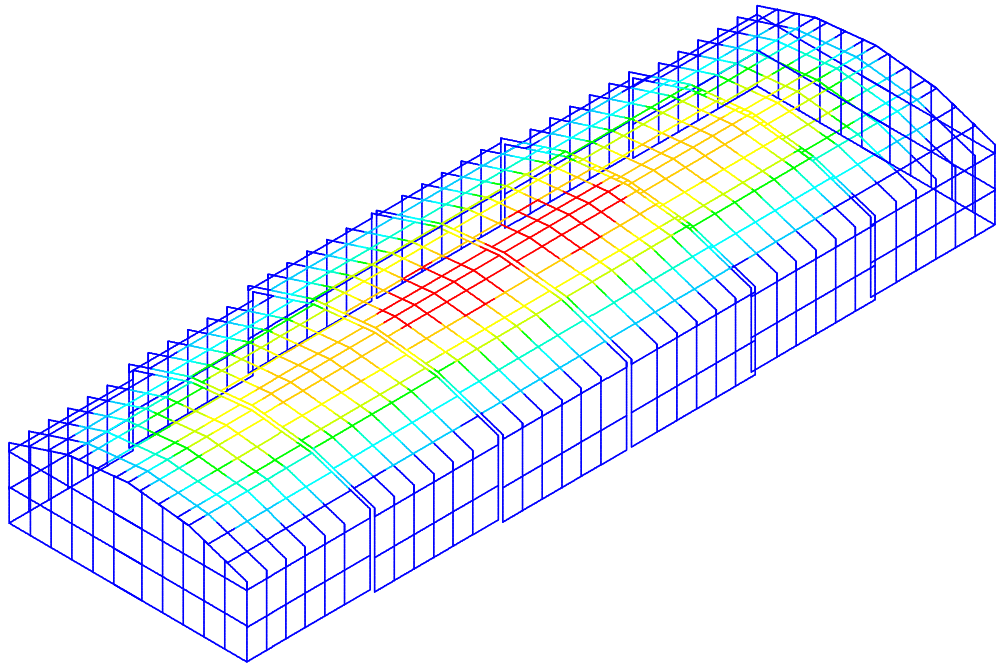
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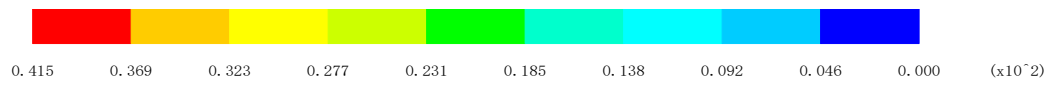
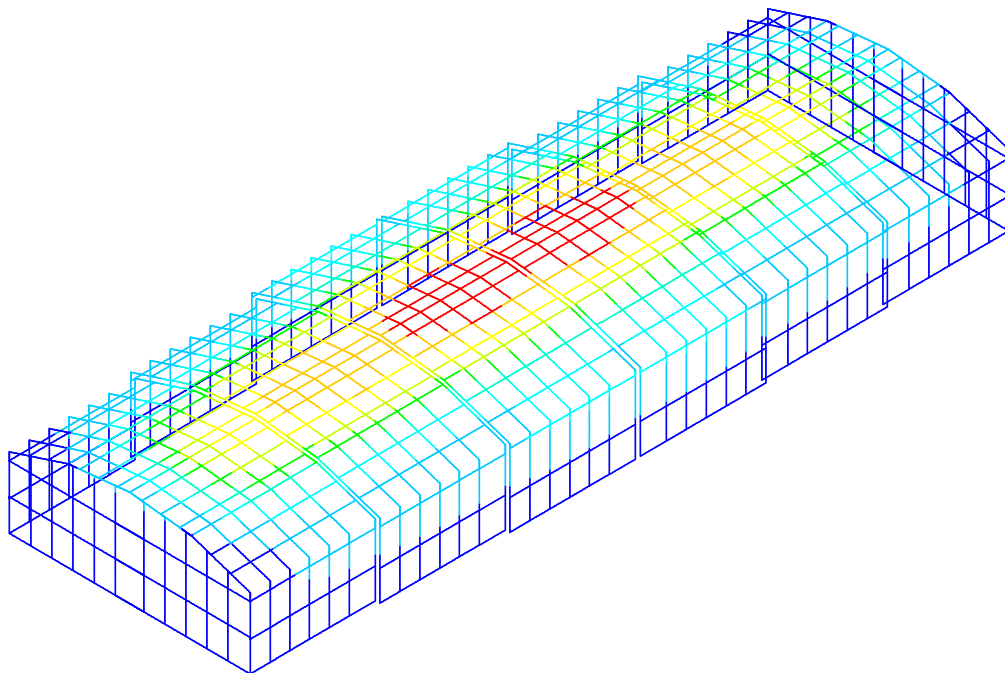
恒载工况 Uxyz:mm (整体)



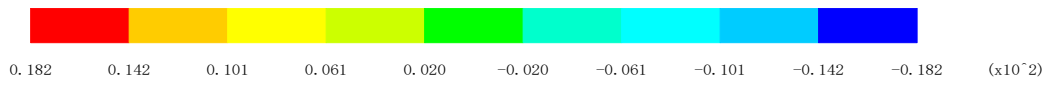
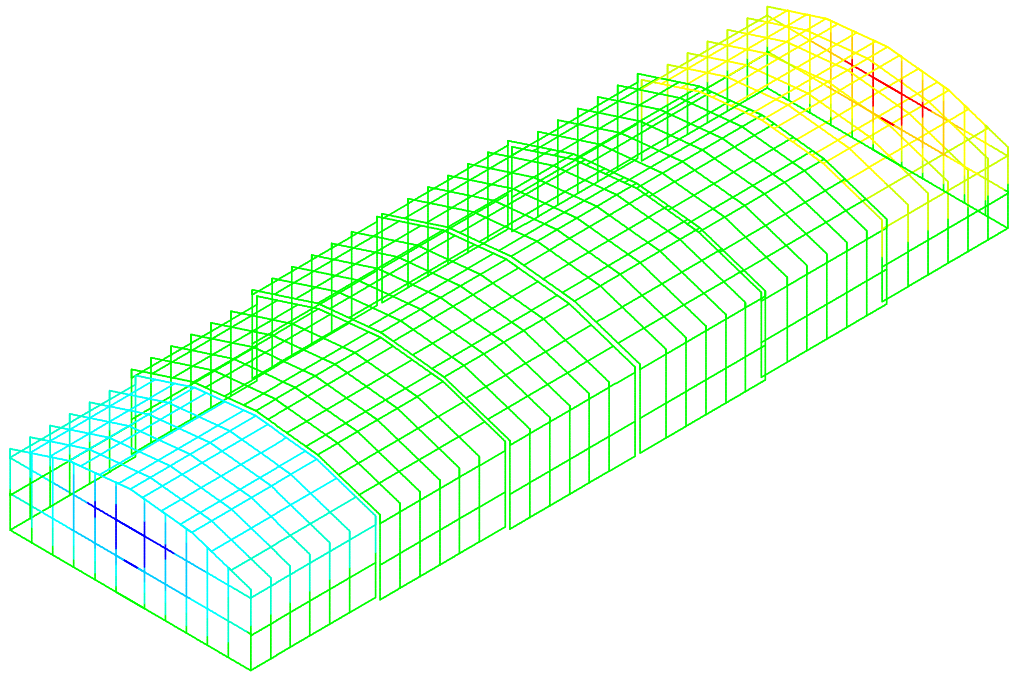
活载工况1 Ux:mm (整体)



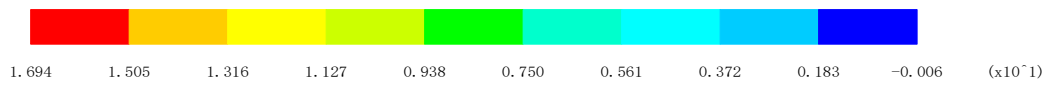
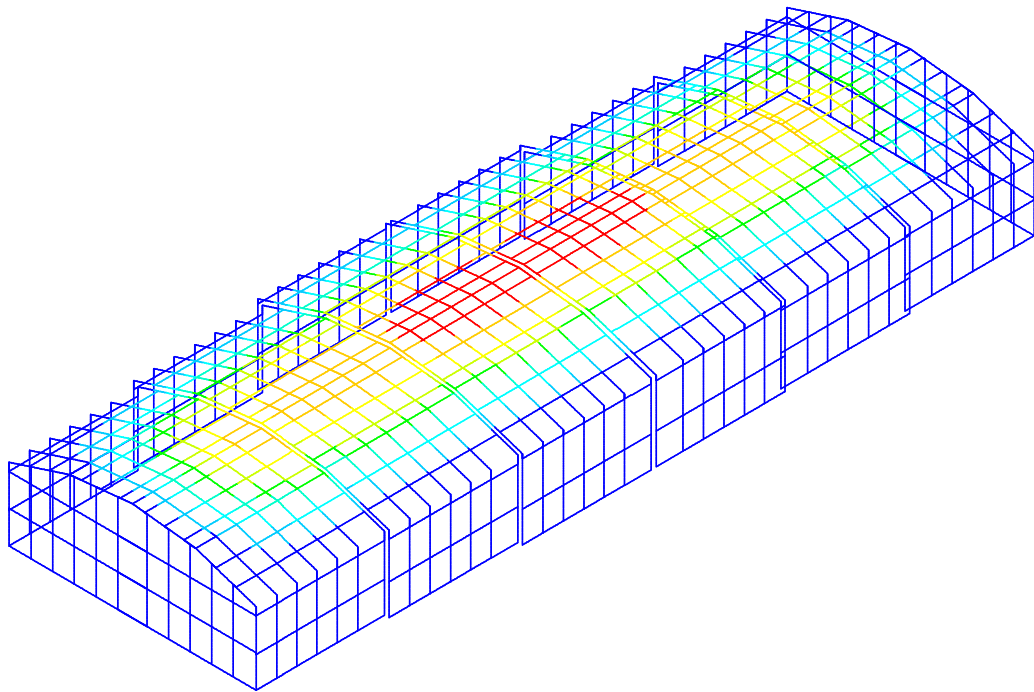
活载工况1 Uz:mm (整体)



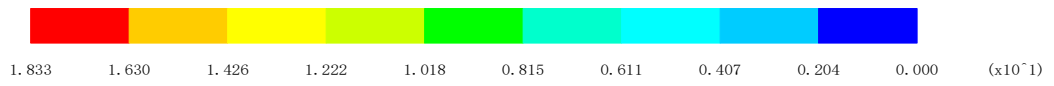
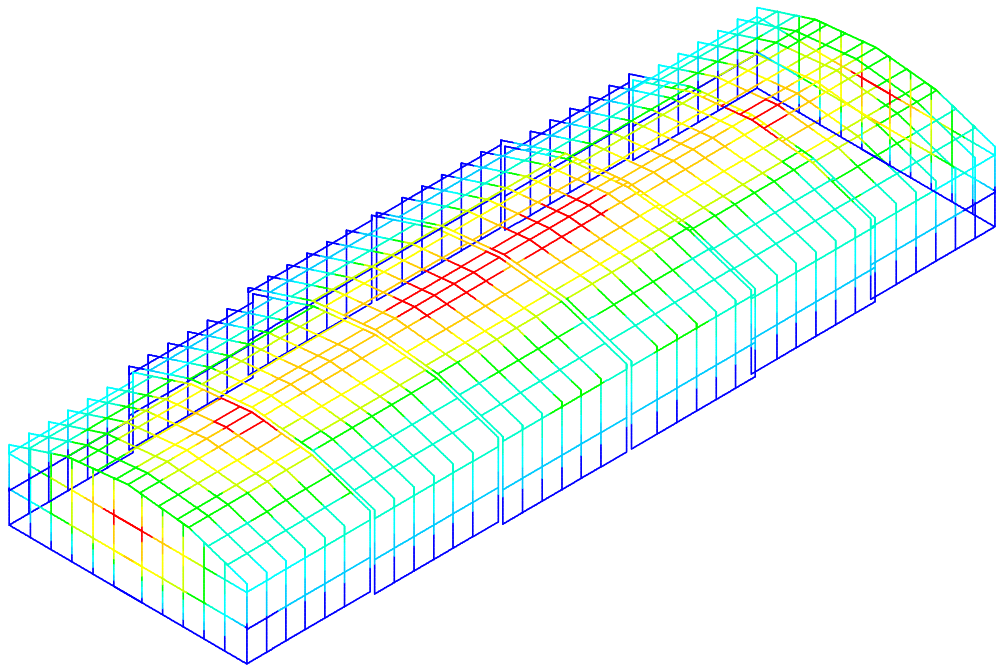
活载工况1 Uxyz:mm (整体)



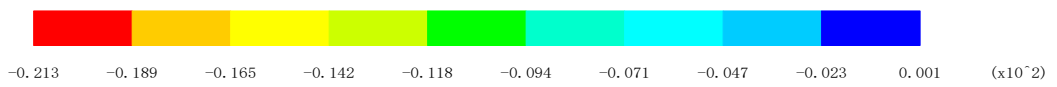
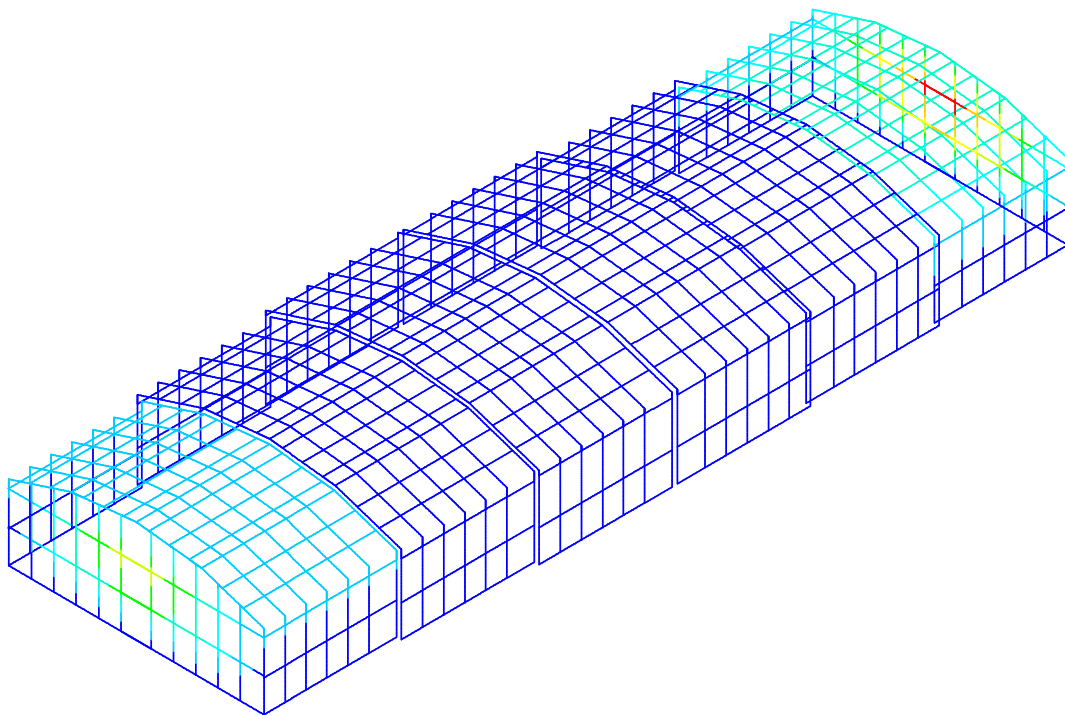
风载工况2_左 Ux:mm (整体)



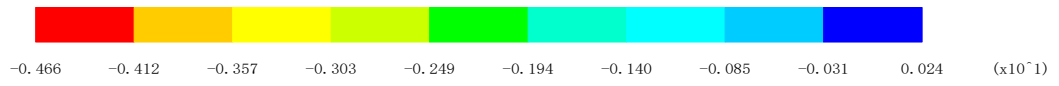
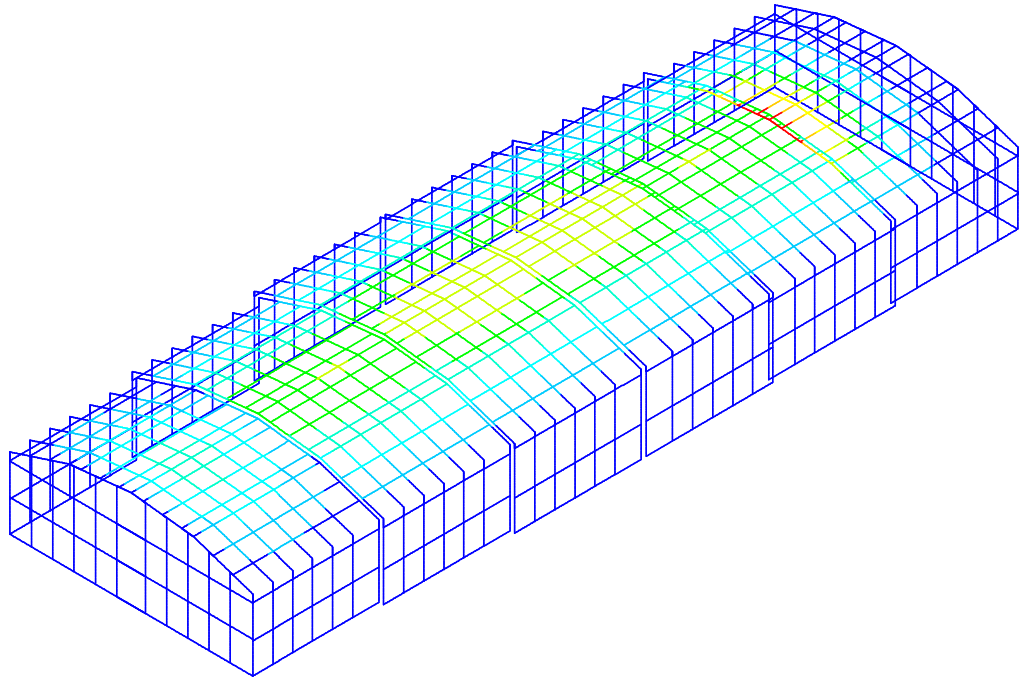
风载工况2_左 Uz:mm (整体)



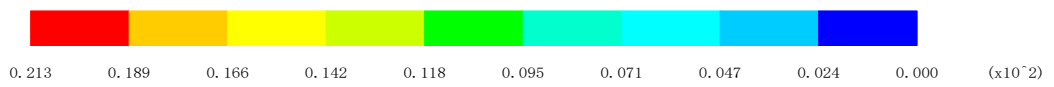
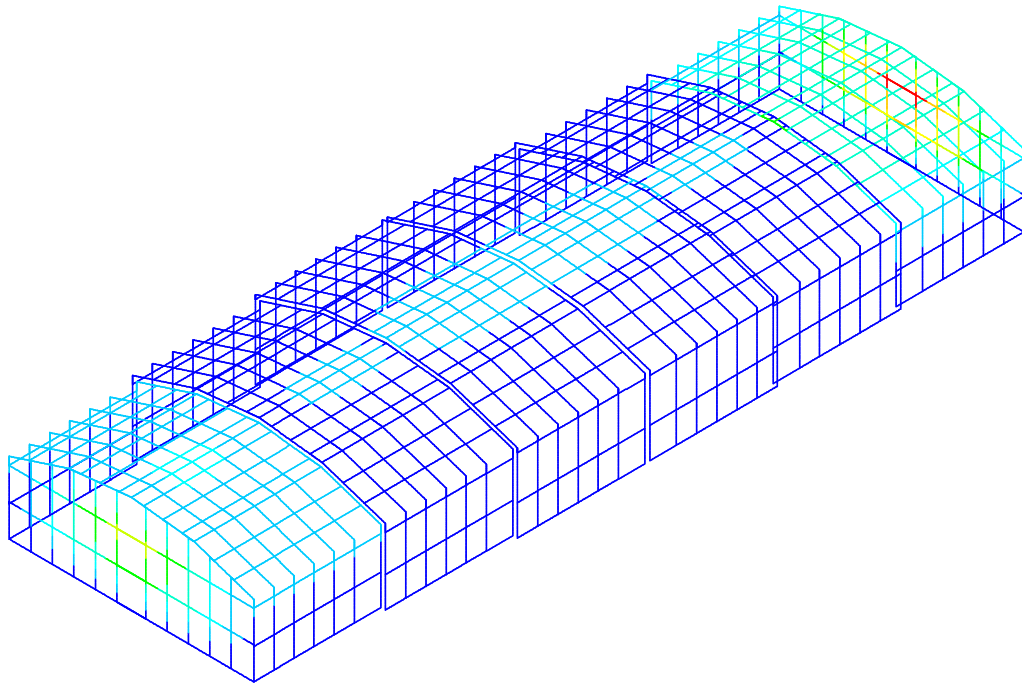
风载工况2_左 Uxyz:mm (整体)



风载工况3_前 Ux:mm (整体)

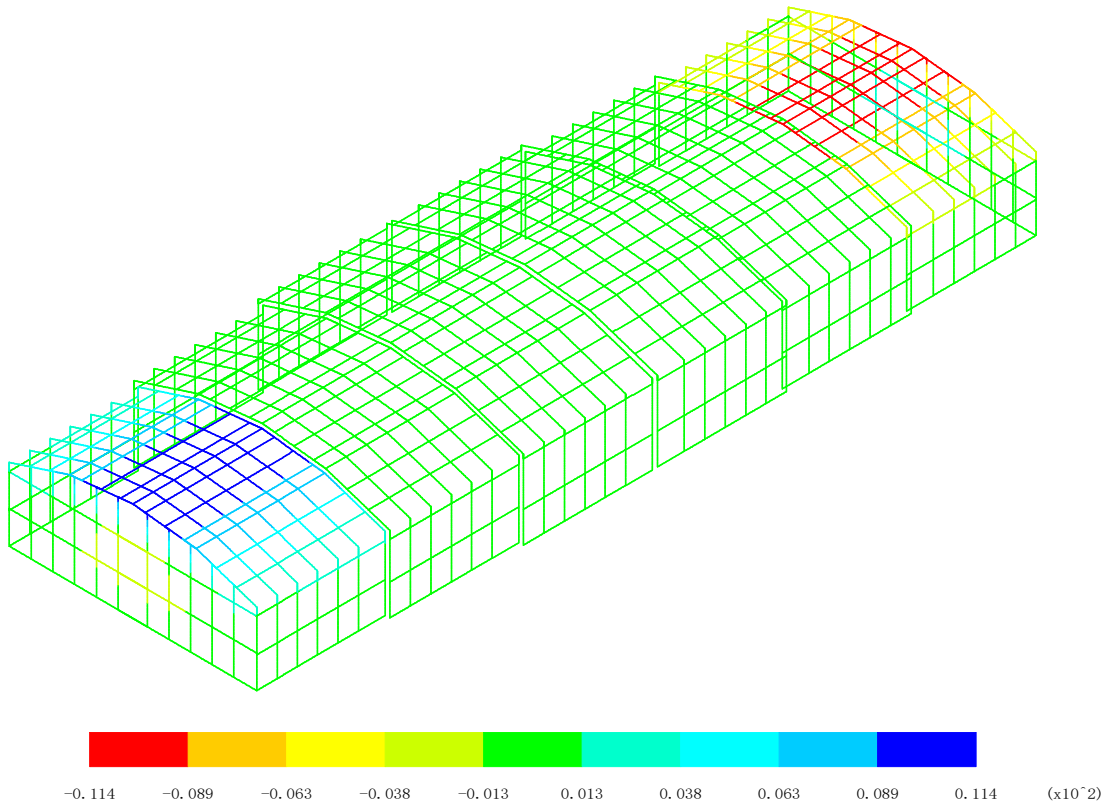


风载工况3_前 Uz:mm (整体)

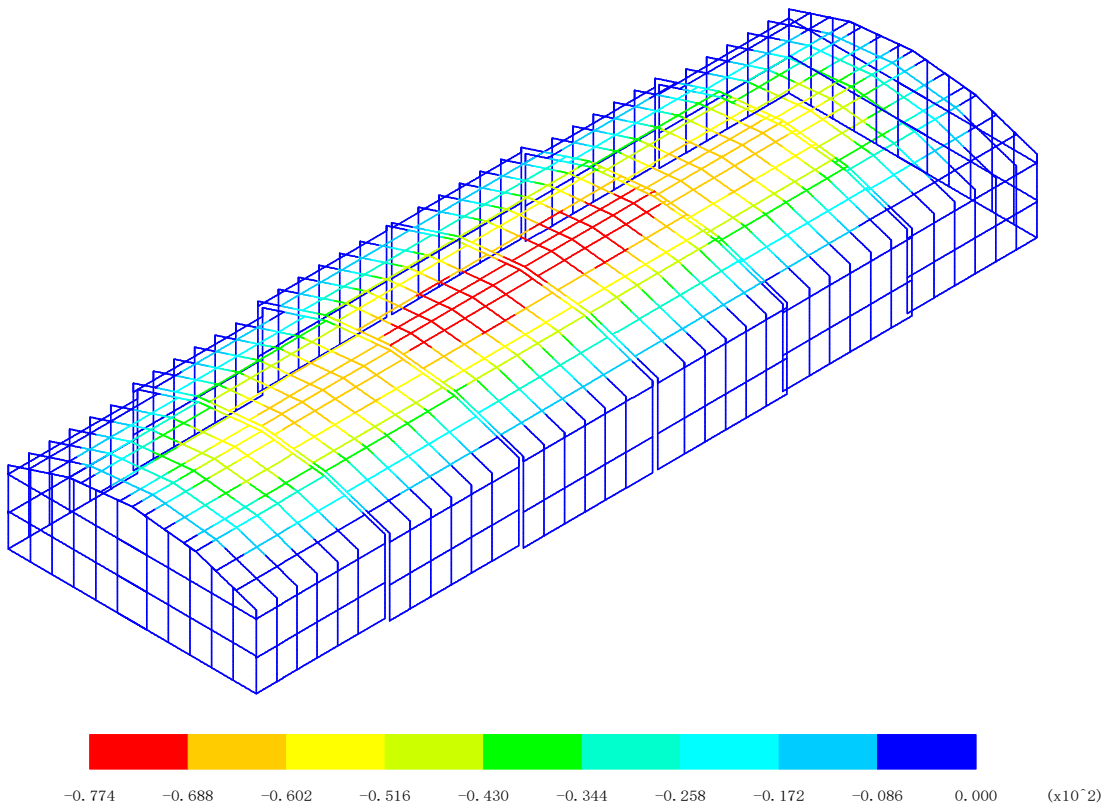


风载工况3_前 Uxyz:mm (整体)

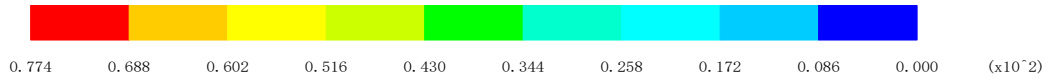
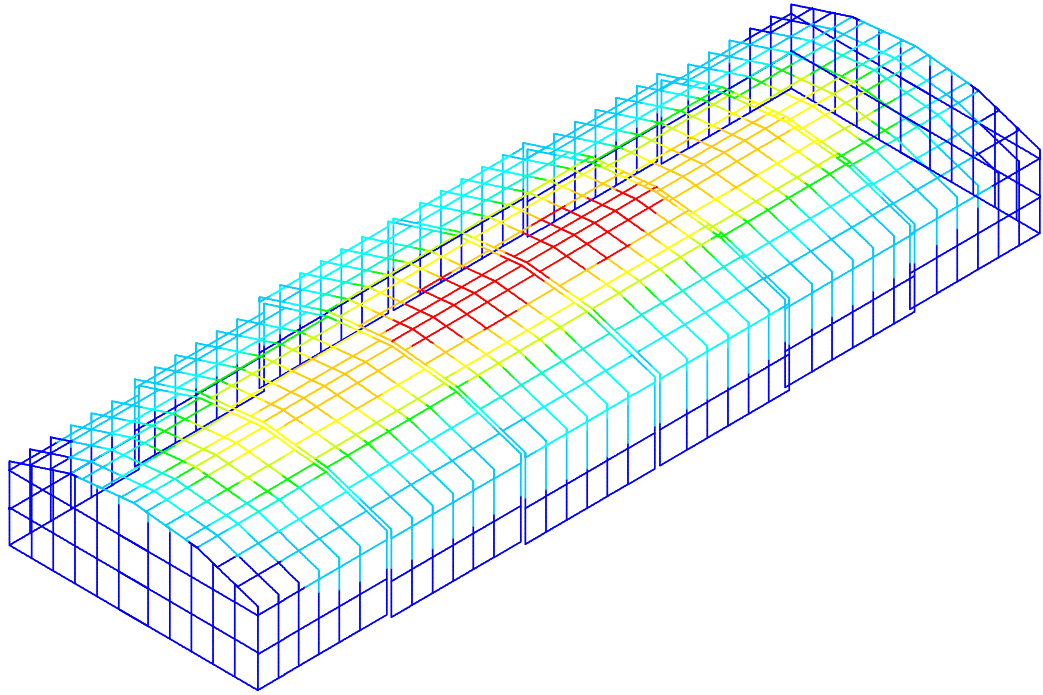
6.2.2 组合位移



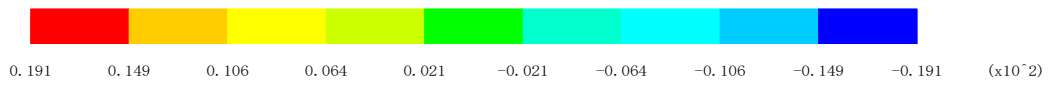
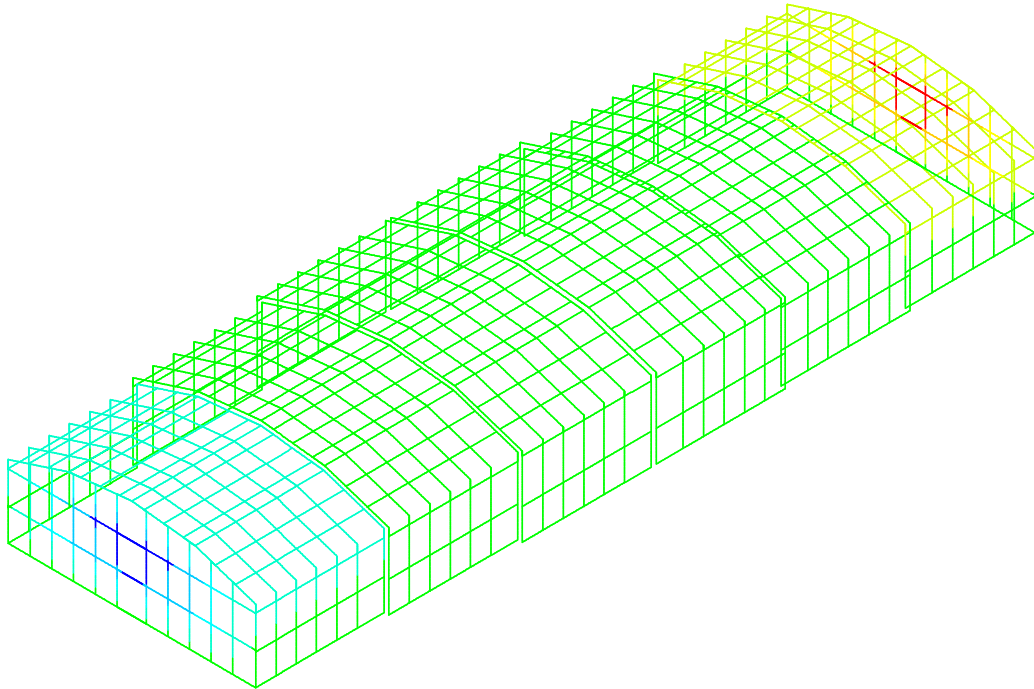
组合1 (恒0+活1) U_x :mm (整体)



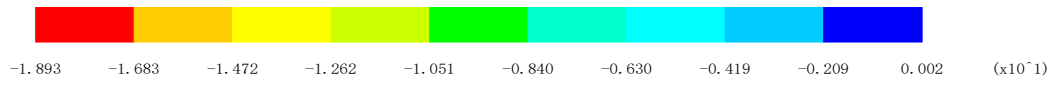
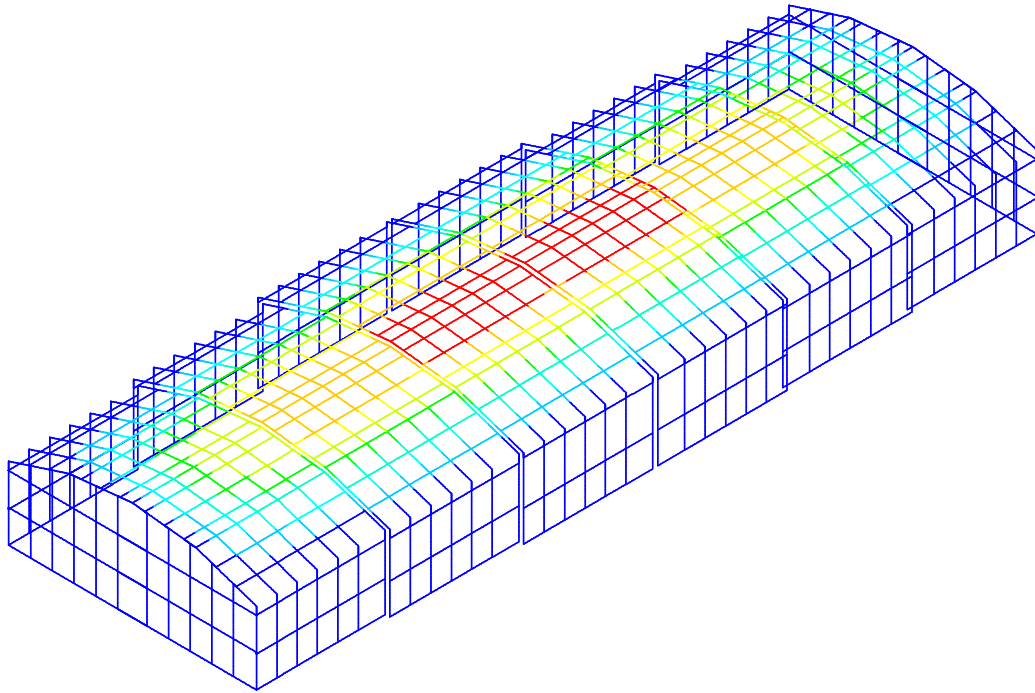
组合1 (恒0+活1) U_z :mm (整体)



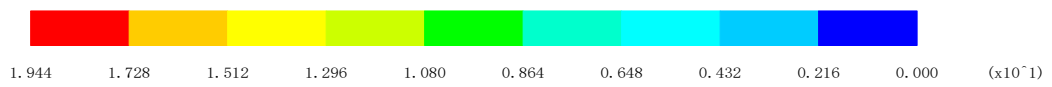
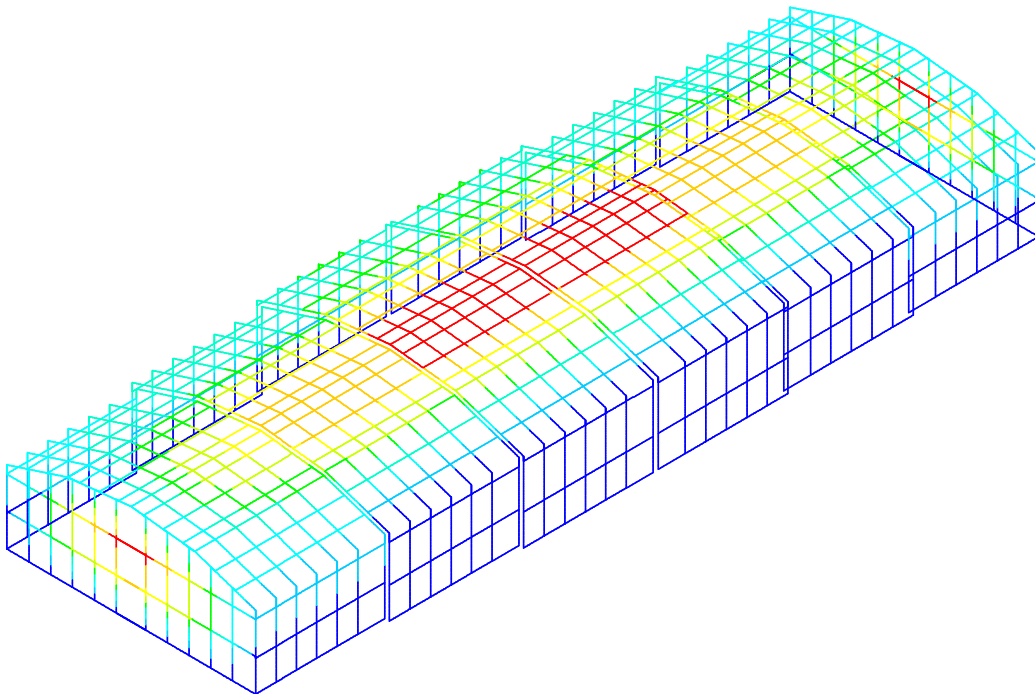
组合1 (恒0+活1) Uxyz:mm (整体)



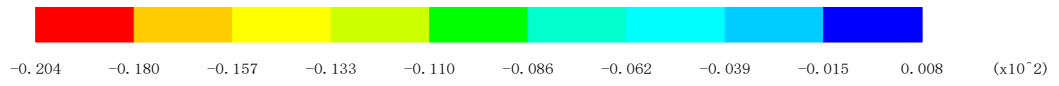
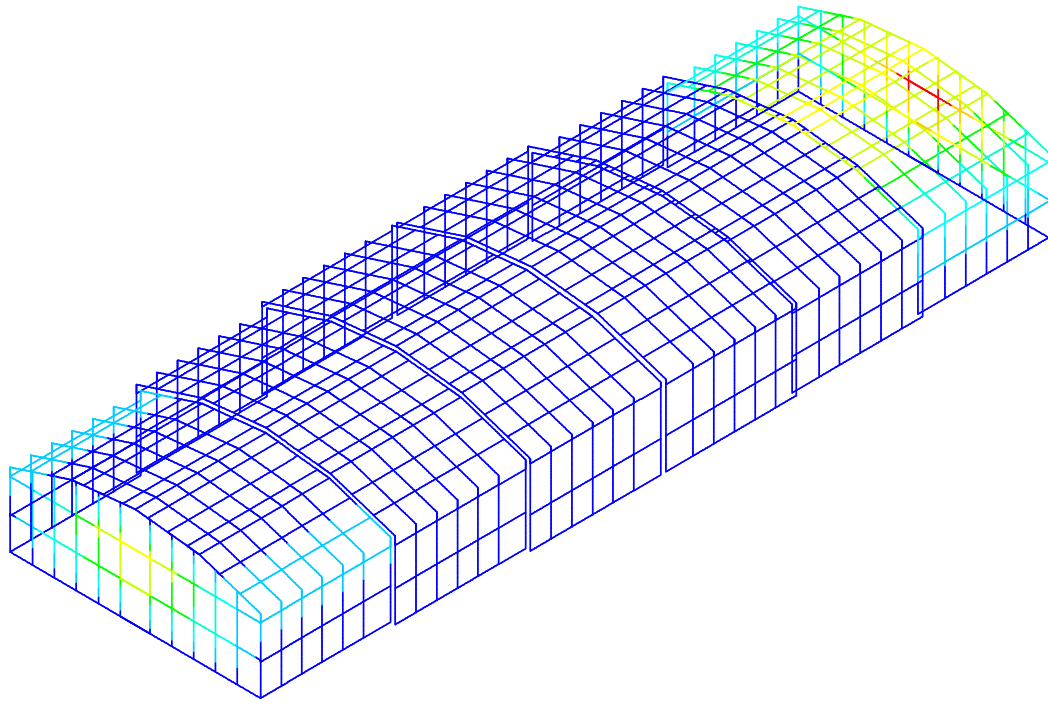
组合2 (恒0+风2) Ux:mm (整体)



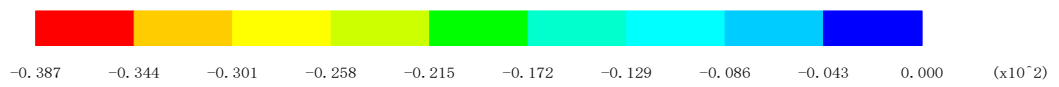
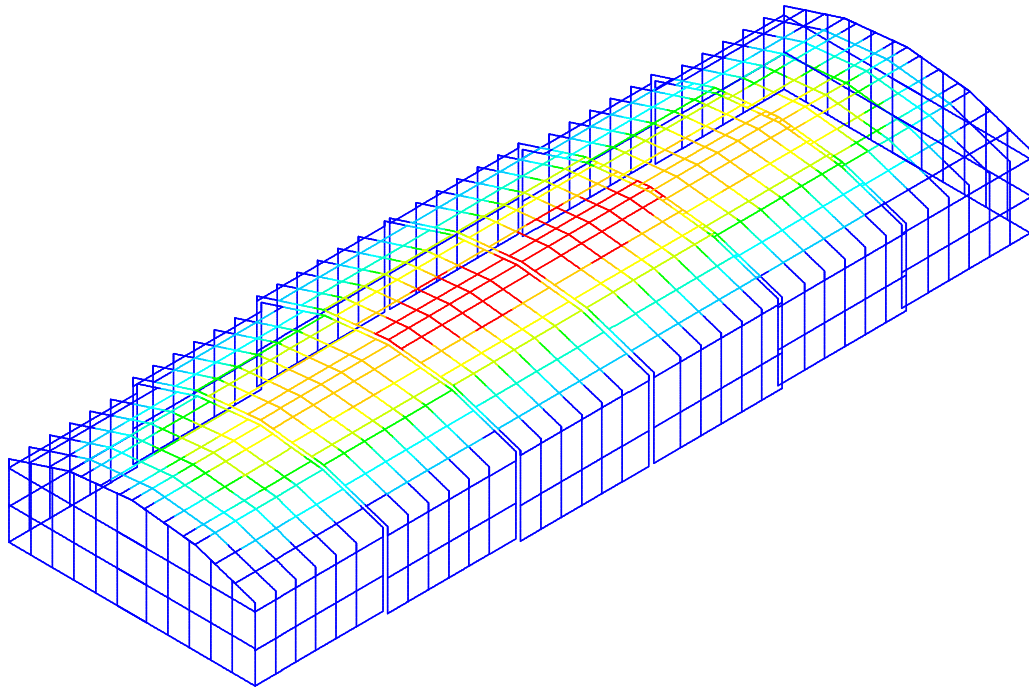
组合2 (恒0+风2) Uz:mm (整体)



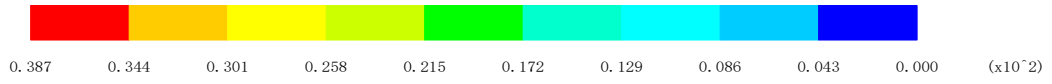
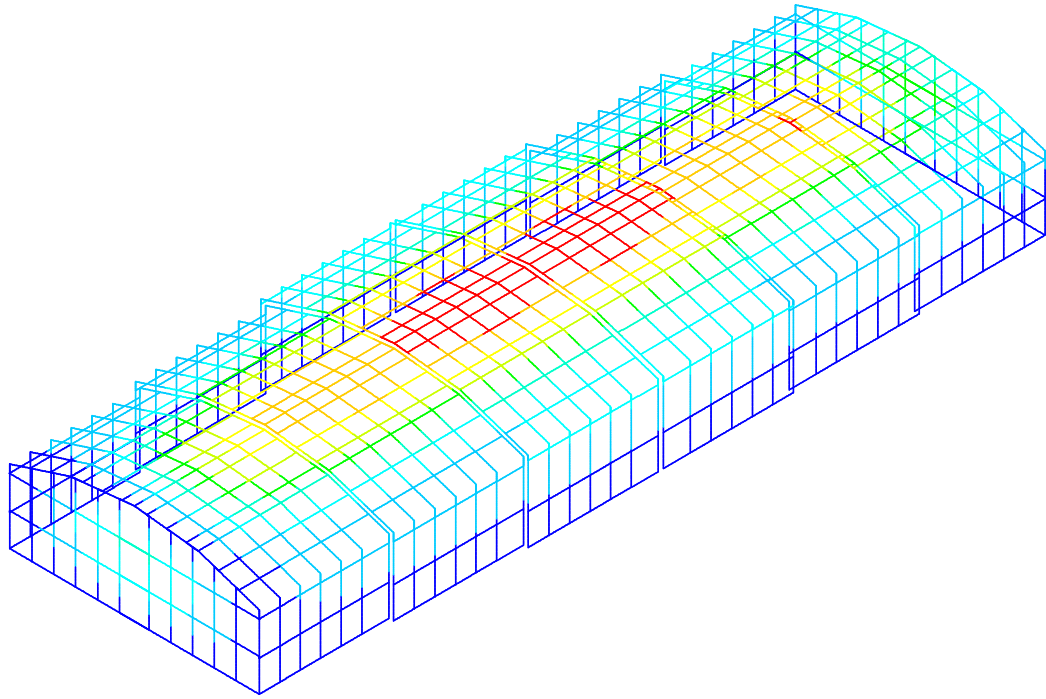
组合2 (恒0+风2) Uxyz:mm (整体)



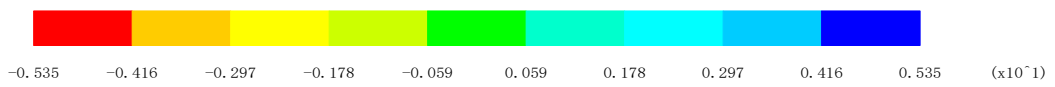
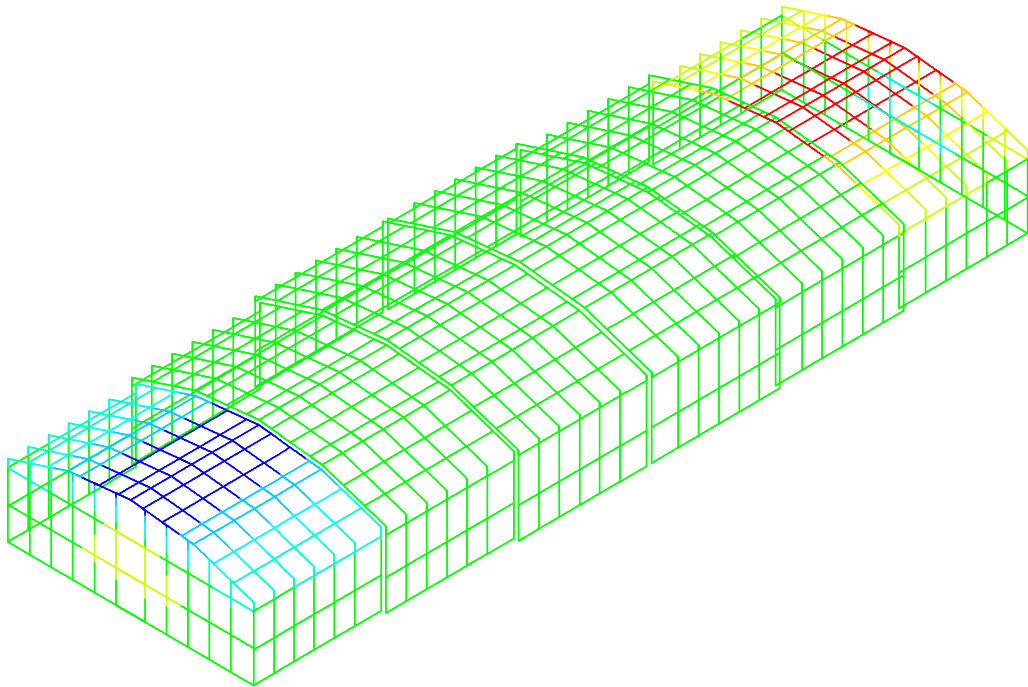
组合3 (恒0+风3) Ux:mm (整体)



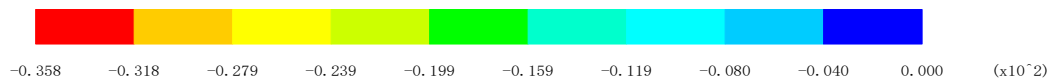
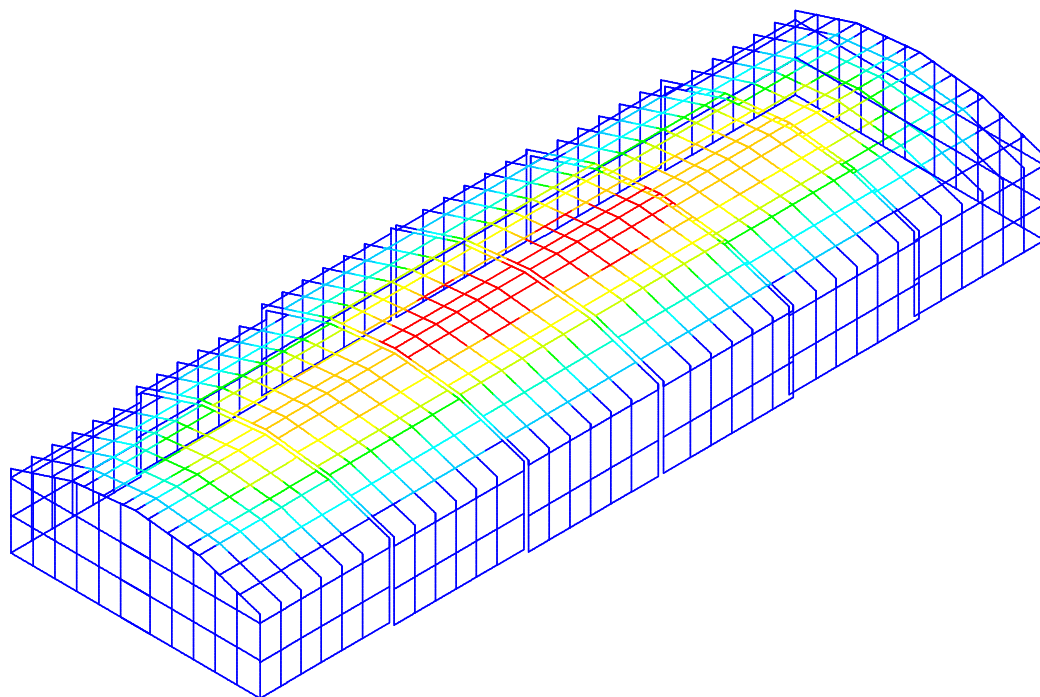
组合3 (恒0+风3) Uz:mm (整体)



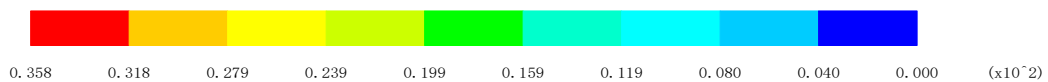
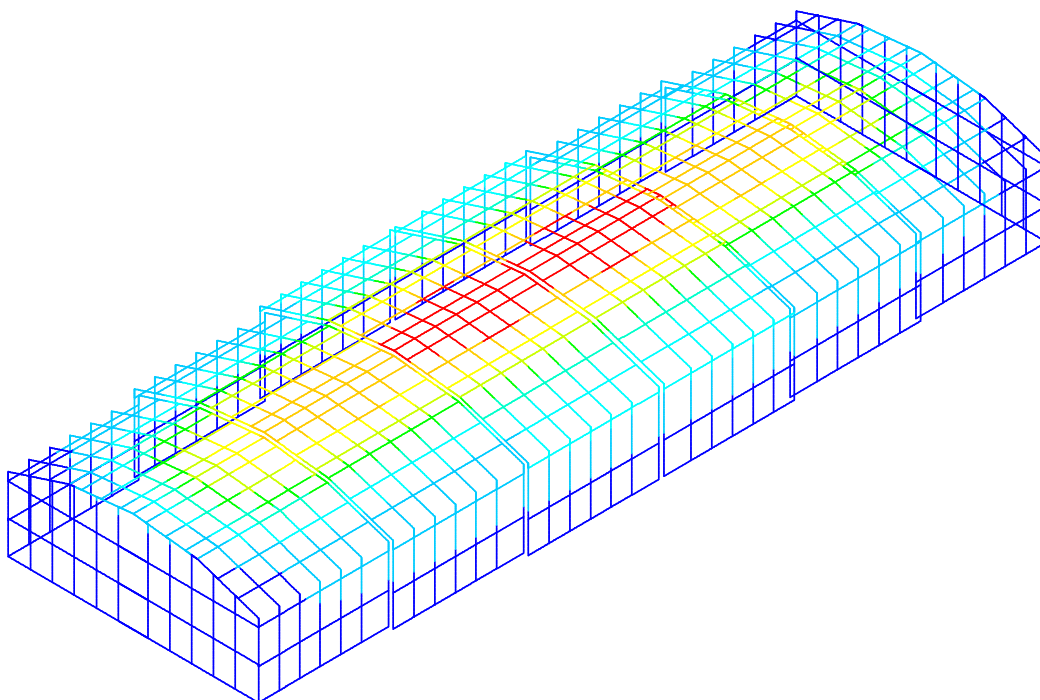
组合3 (恒0+风3) Uxyz:mm (整体)



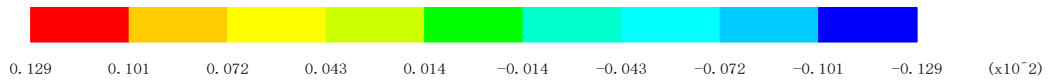
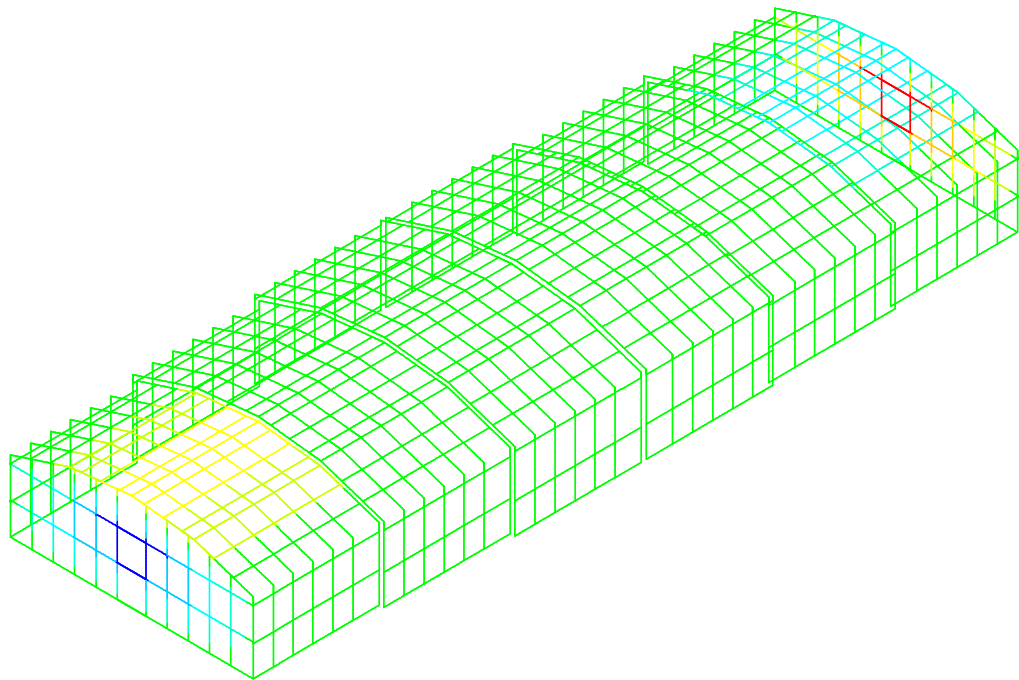
组合4 (恒0) Ux:mm (整体)



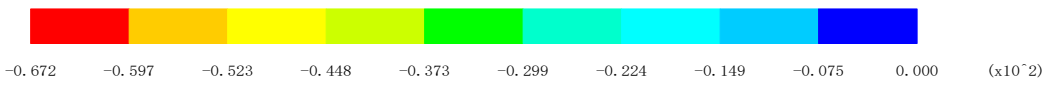
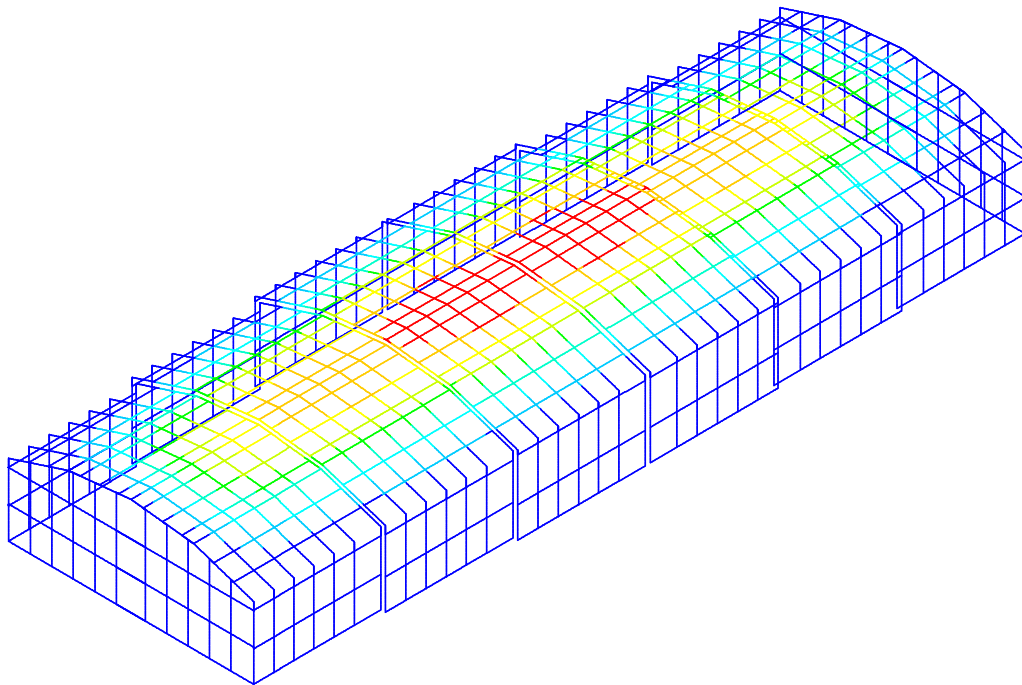
组合4 (恒0) Uz:mm (整体)



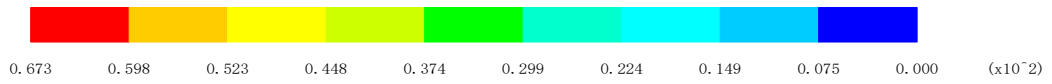
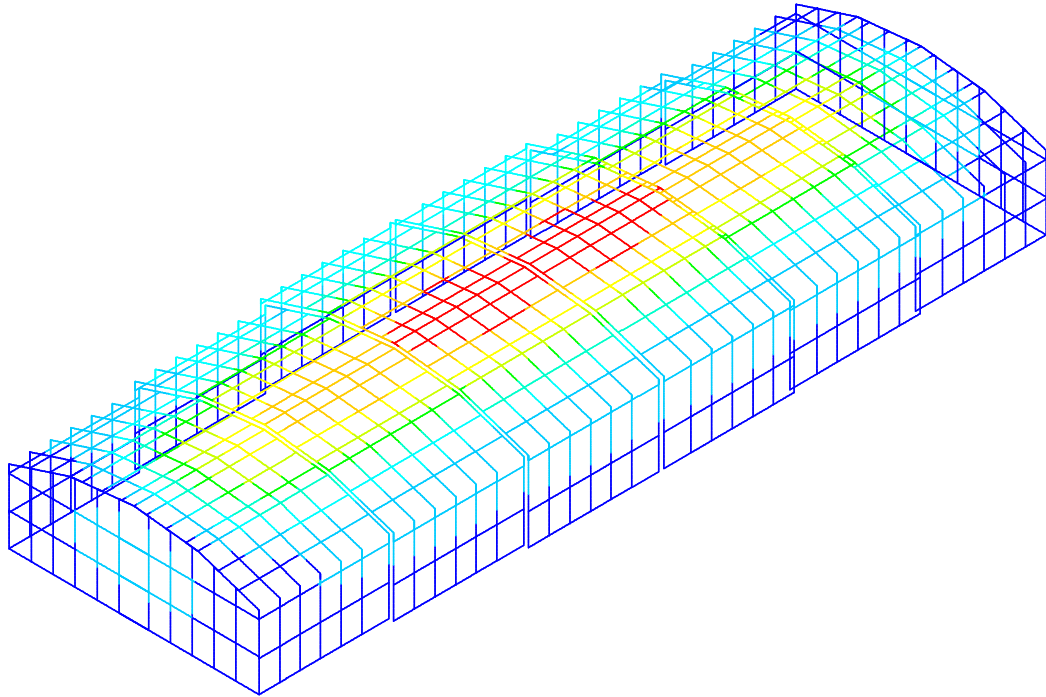
组合4 (恒0) Uxyz:mm (整体)



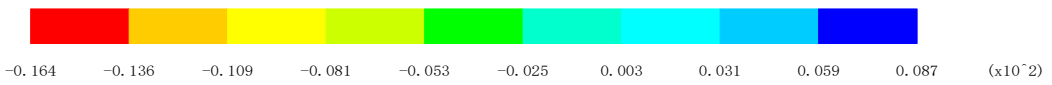
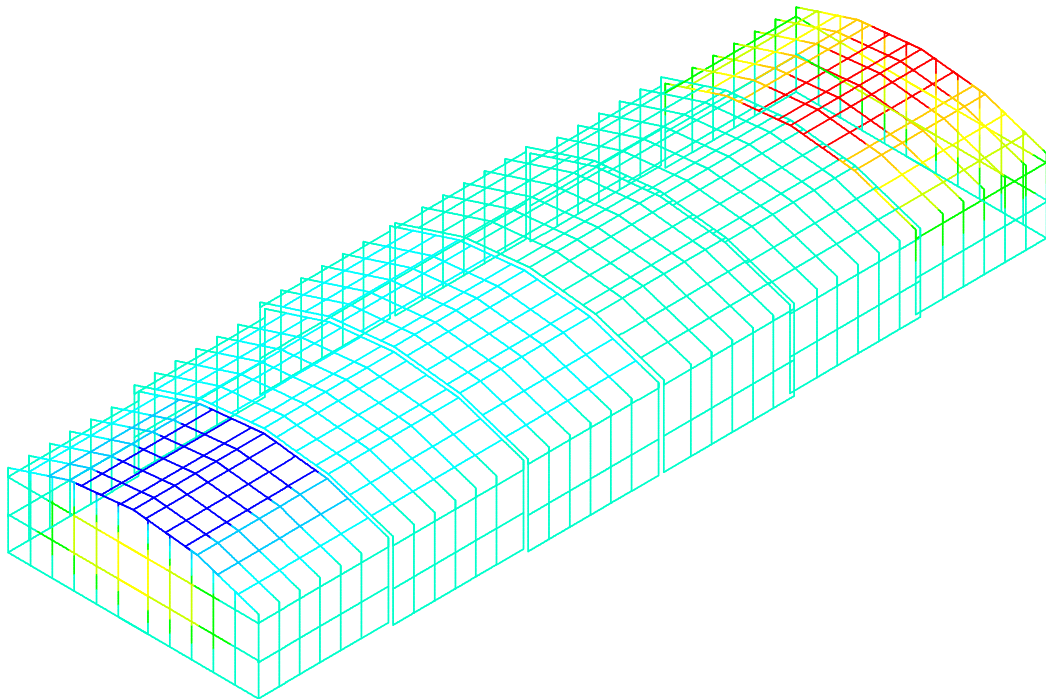
组合5 (恒0+活1+0.6风2) Ux:mm (整体)



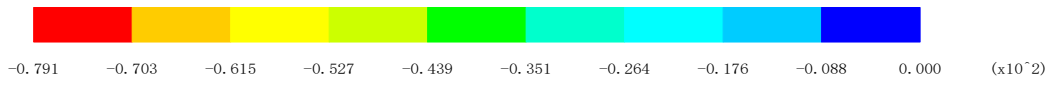
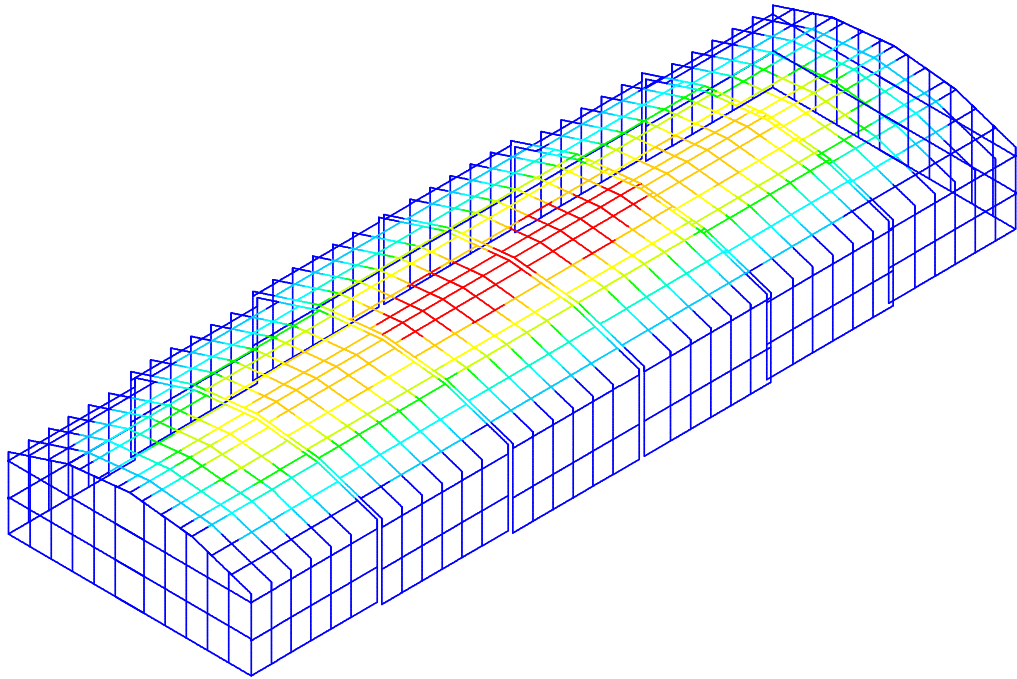
组合5 (恒0+活1+0.6风2) Uz:mm (整体)



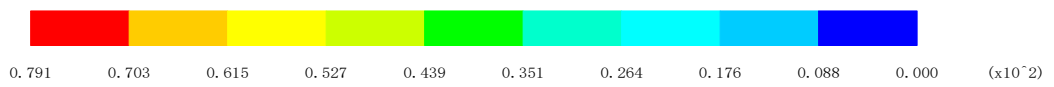
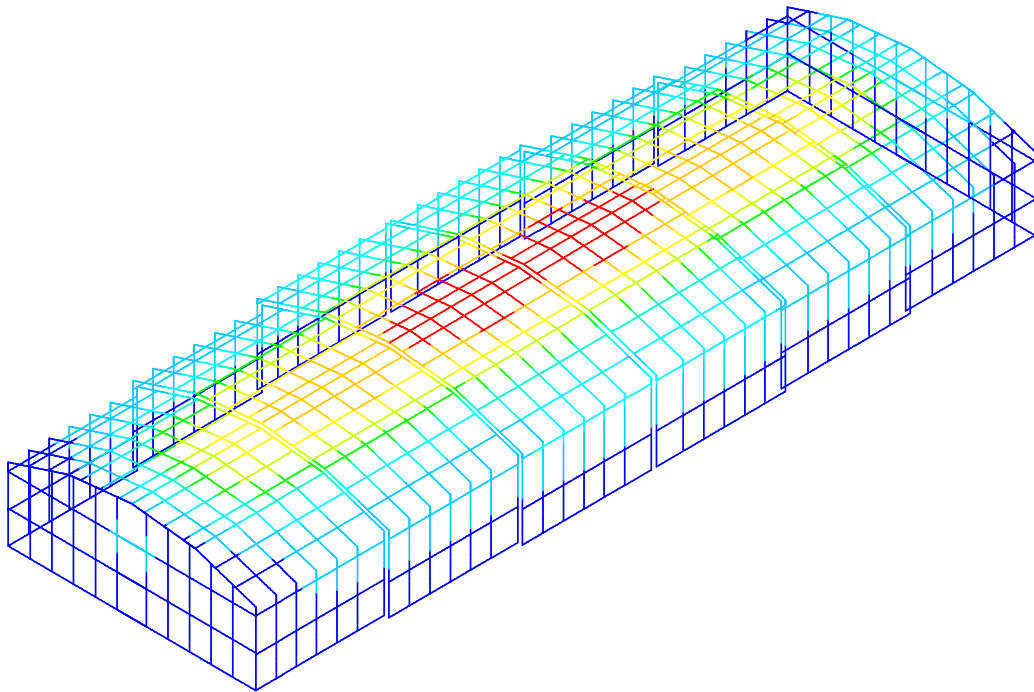
组合5 (恒0+活1+0.6风2) Uxyz:mm (整体)



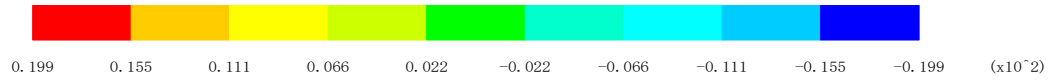
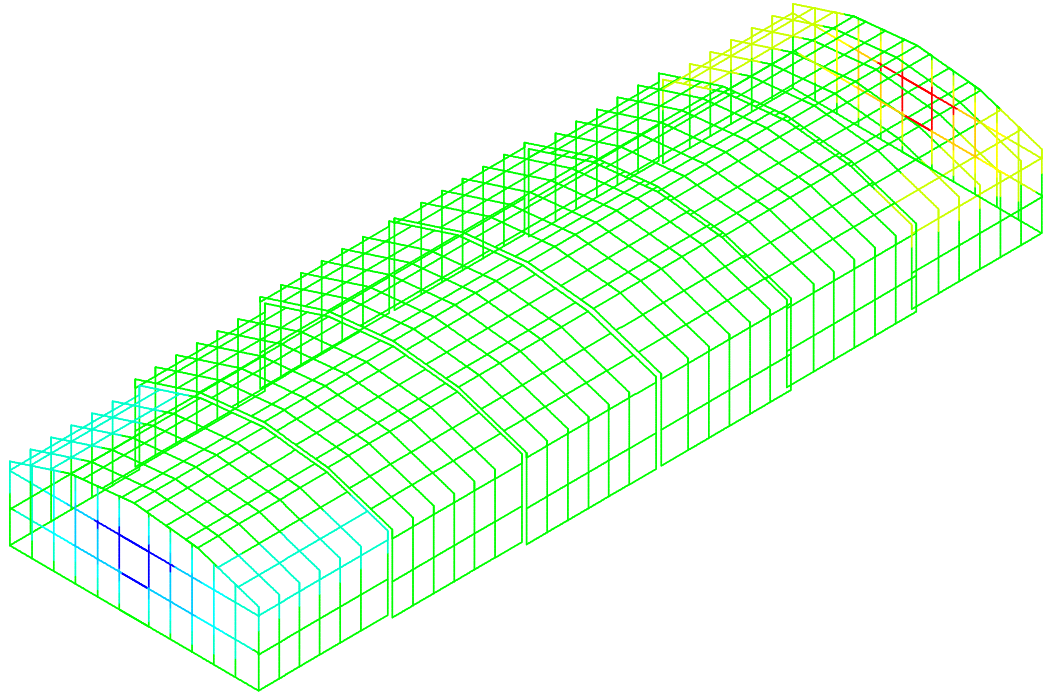
组合6 (恒0+活1+0.6风3) Ux:mm (整体)



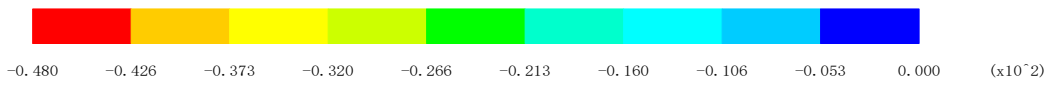
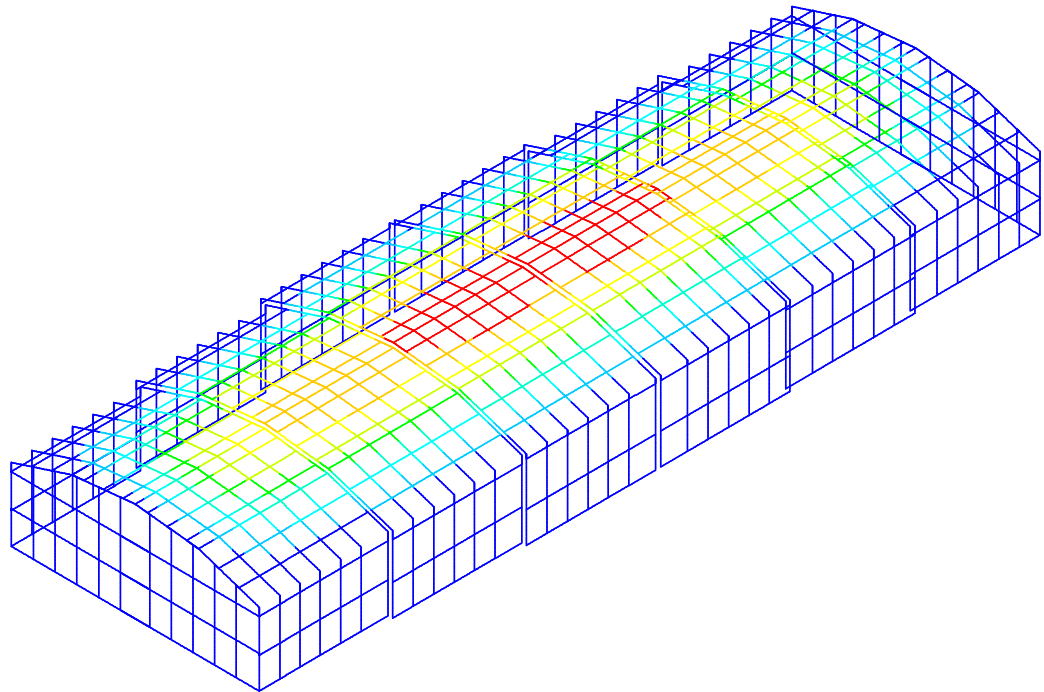
组合6 (恒0+活1+0.6风3) Uz:mm (整体)



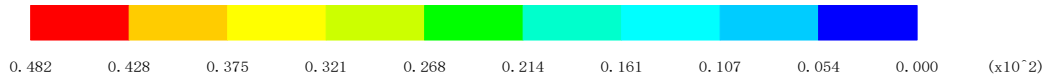
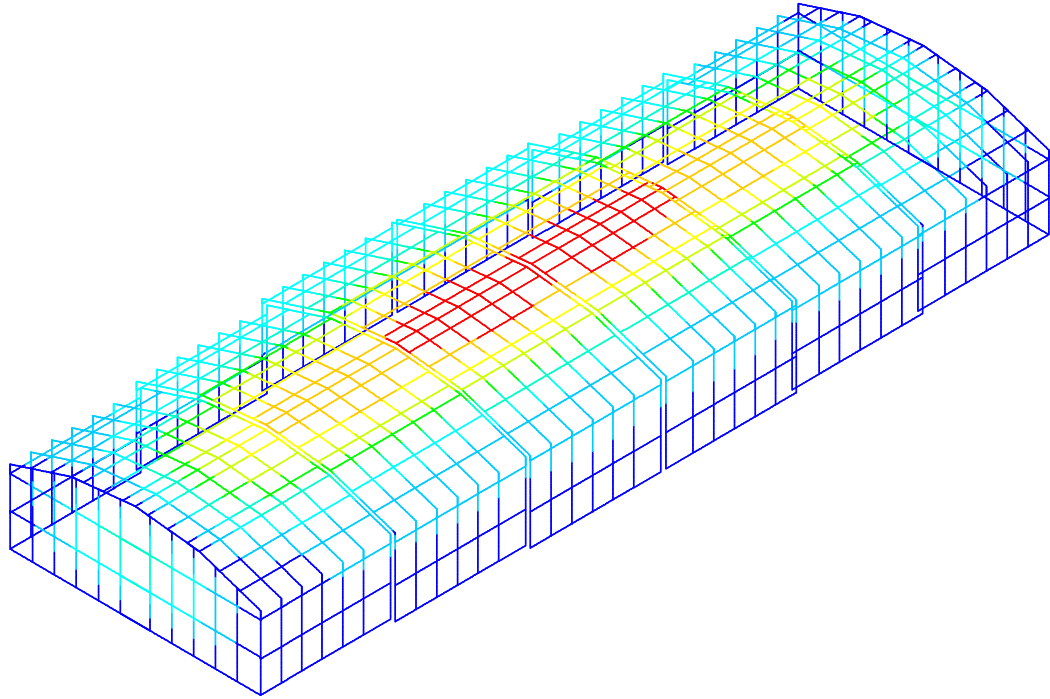
组合6 (恒0+活1+0.6风3) Uxyz:mm (整体)



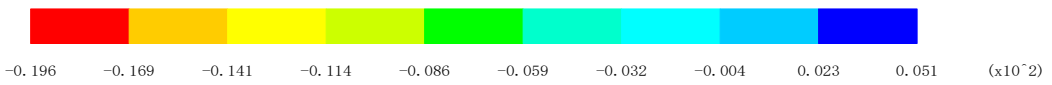
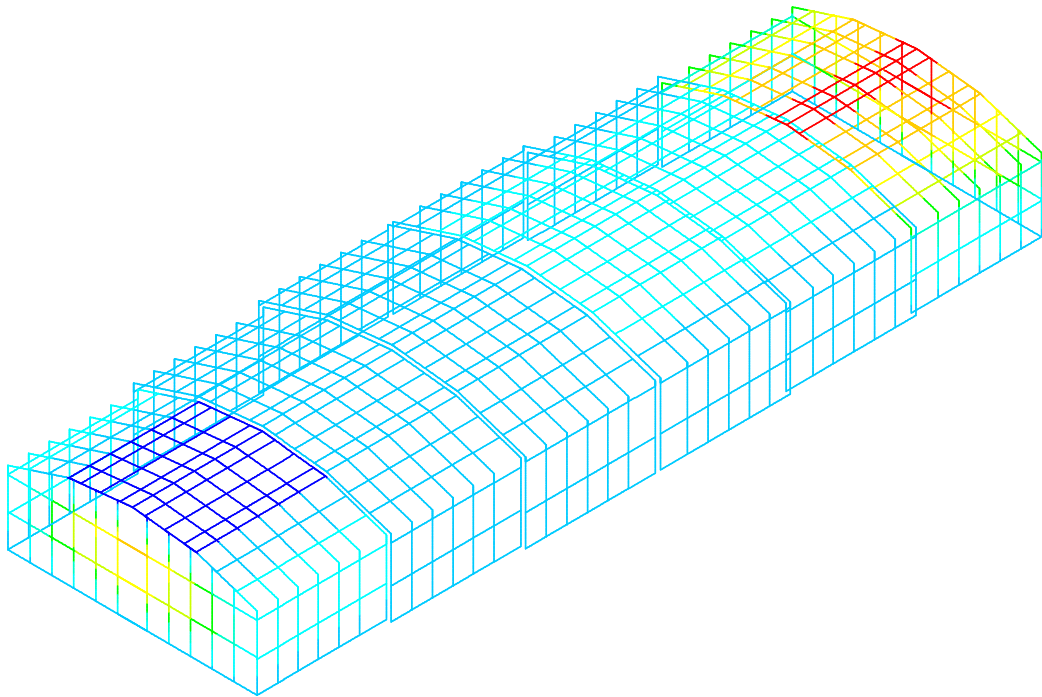
组合7 (恒0+0.7活1+风2) U_x:mm (整体)



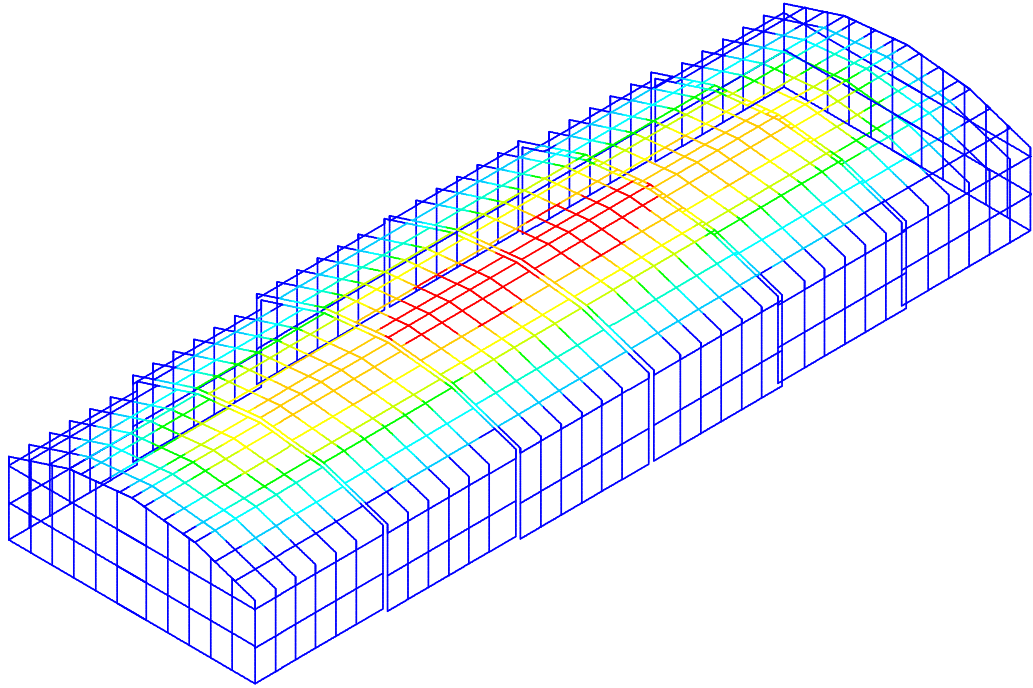
组合7 (恒0+0.7活1+风2) U_z:mm (整体)



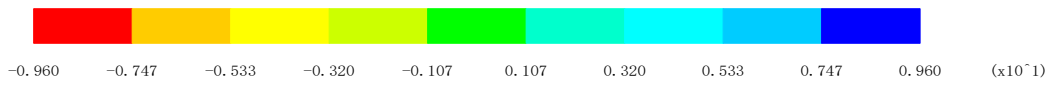
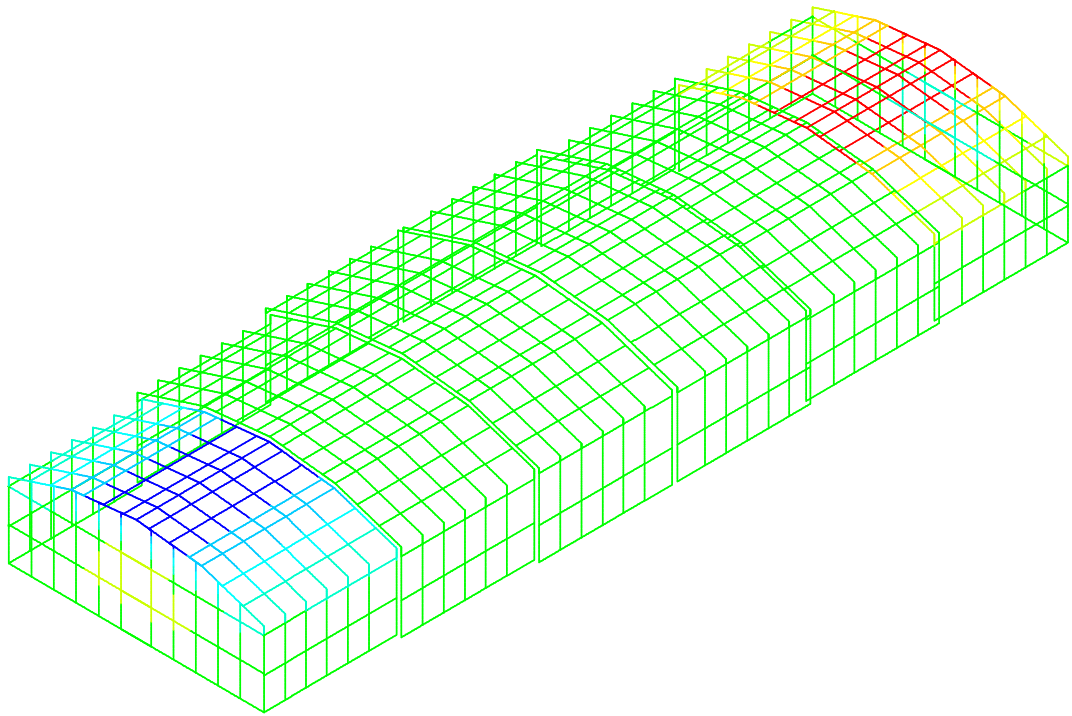
组合7 (恒0+0.7活1+风2) Uxyz:mm (整体)



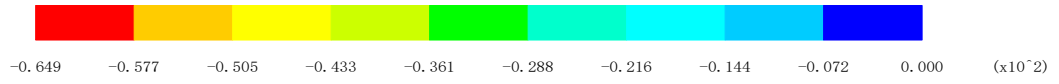
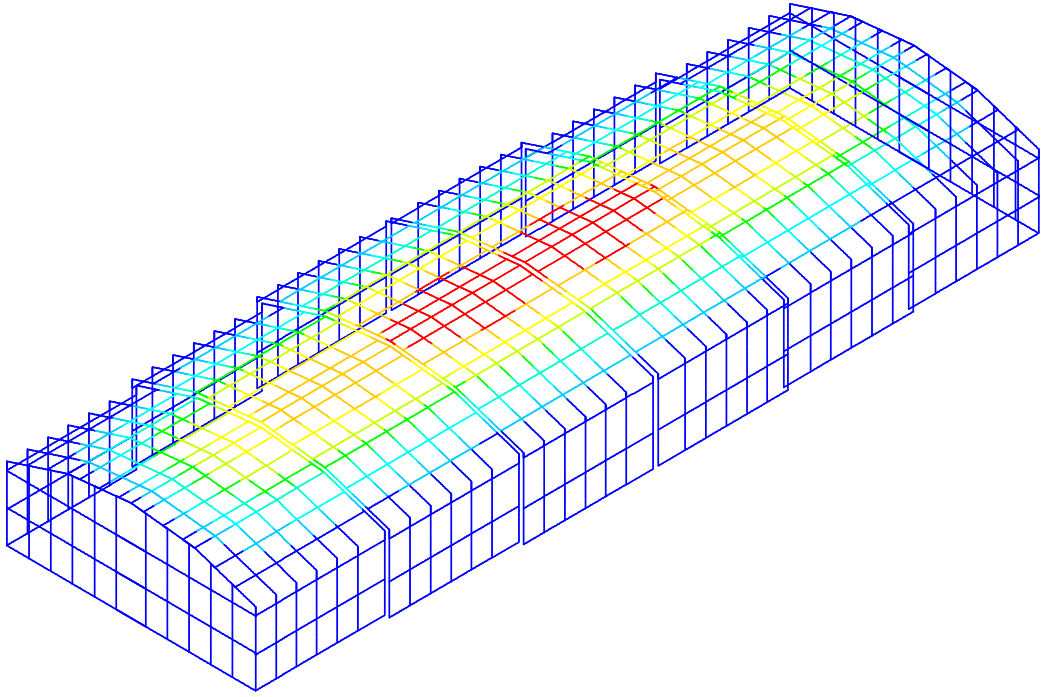
组合8 (恒0+0.7活1+风3) Ux:mm (整体)



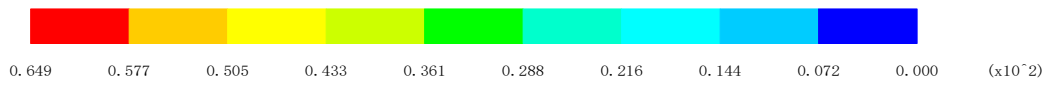
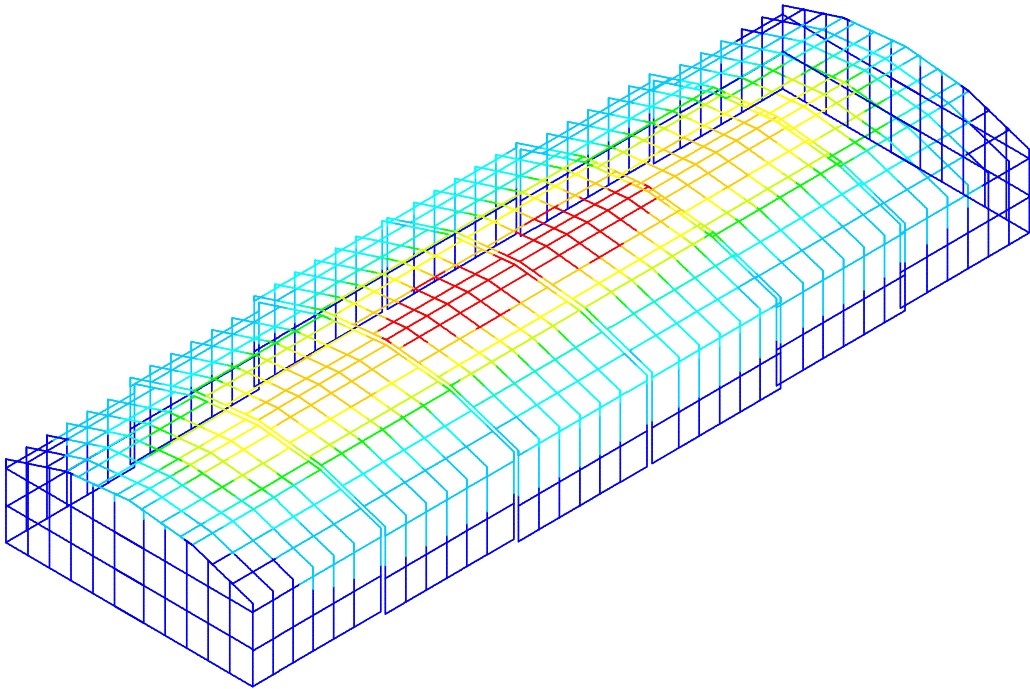
1.1.1



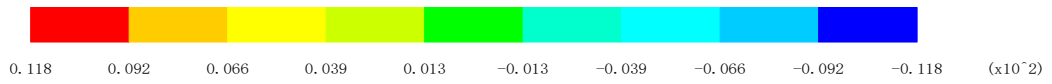
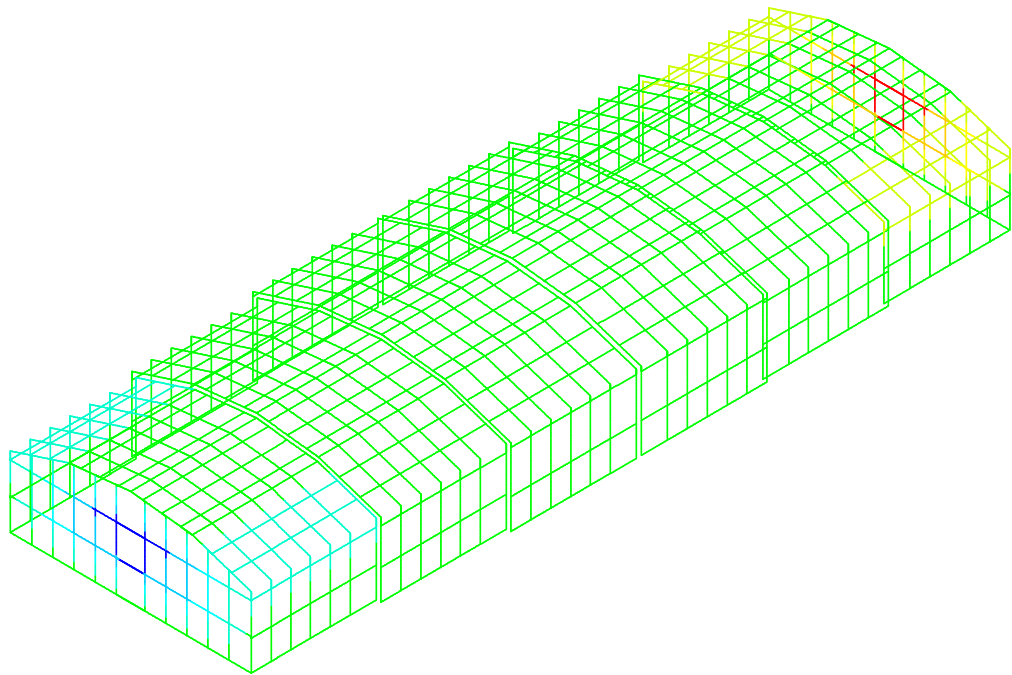
组合9 (恒0+0.7活1) Ux:mm (整体)



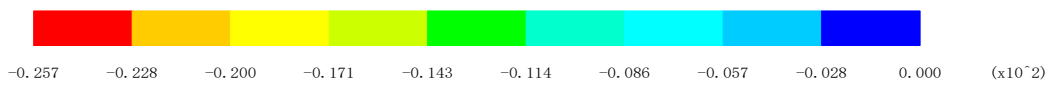
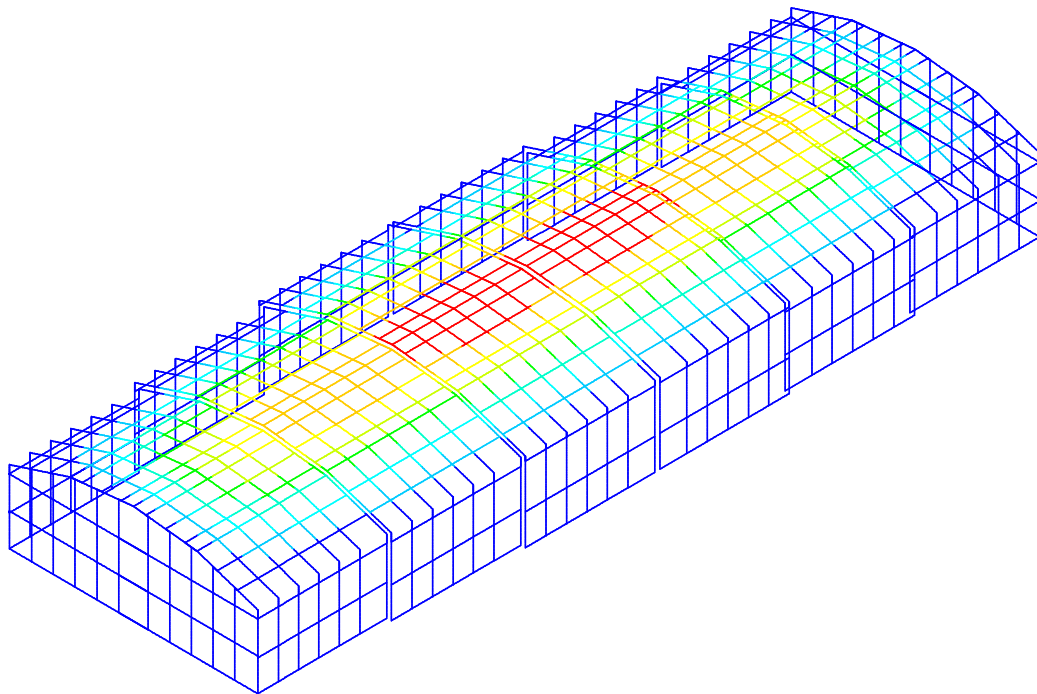
组合9 (恒0+0.7活1) Uz:mm (整体)



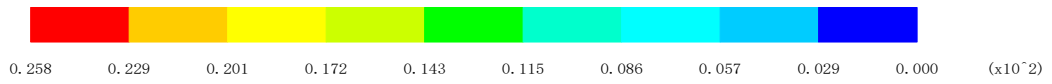
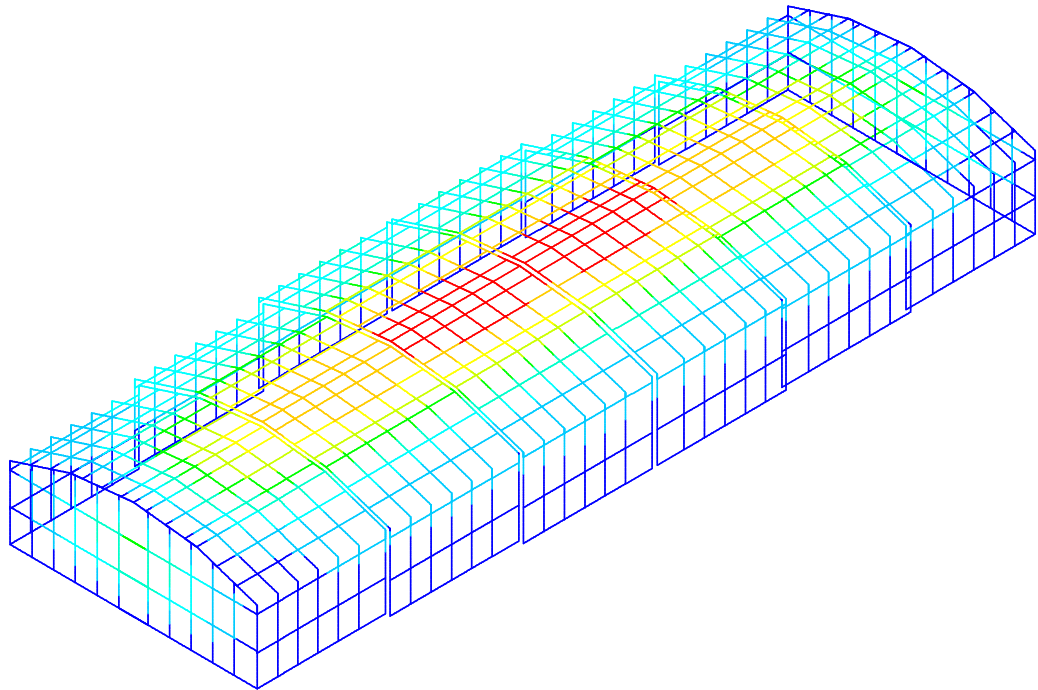
组合9 (恒0+0.7活1) Uxyz:mm (整体)



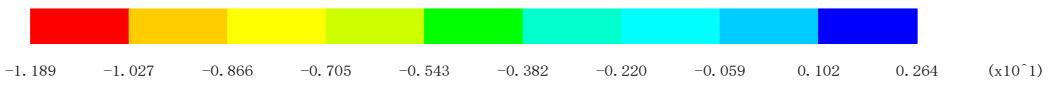
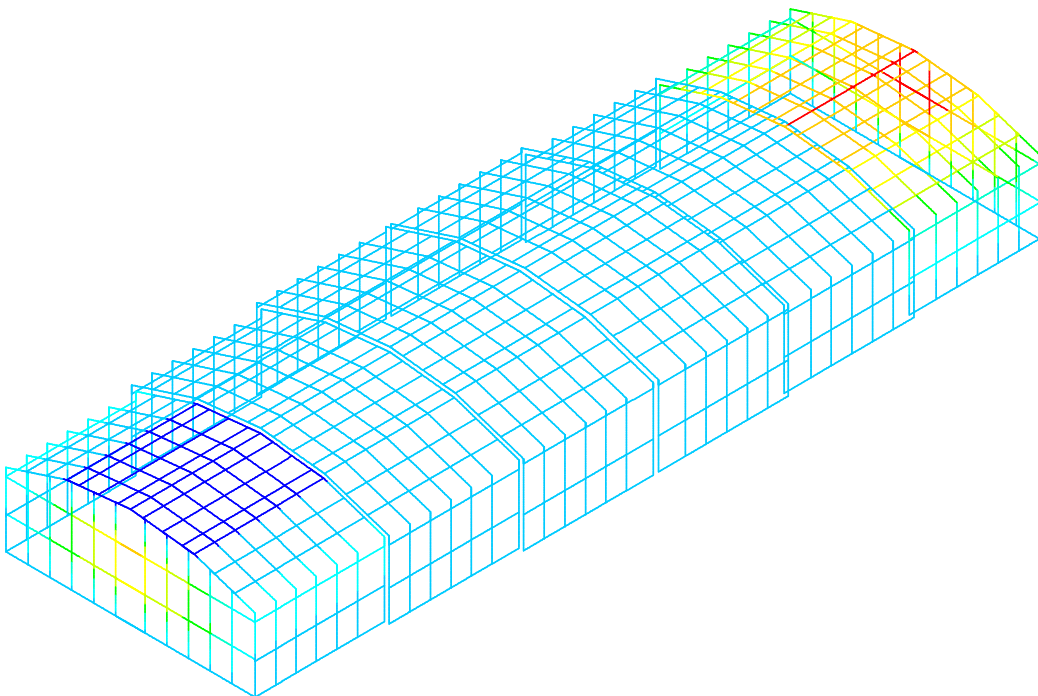
组合10 (恒0+0.6风2) U_x:mm (整体)



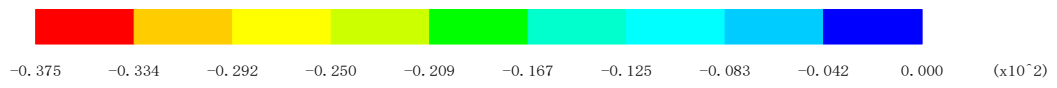
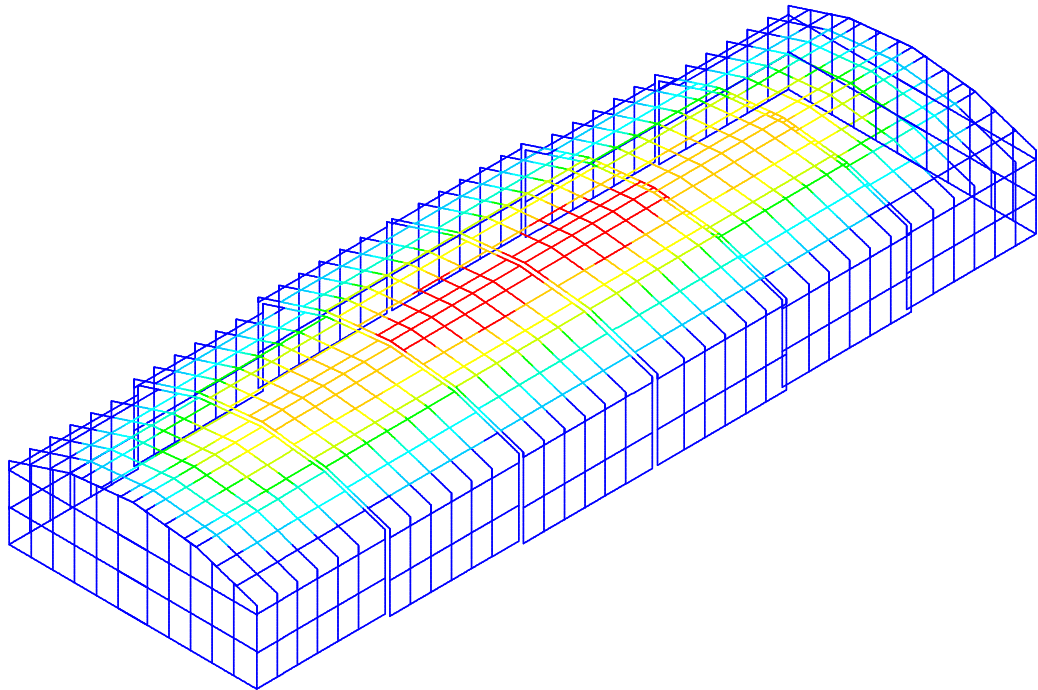
组合10 (恒0+0.6风2) U_z:mm (整体)



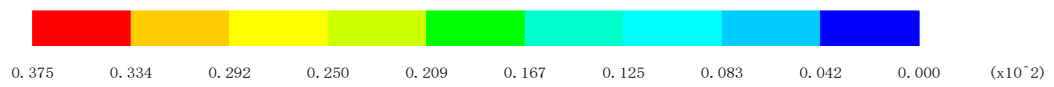
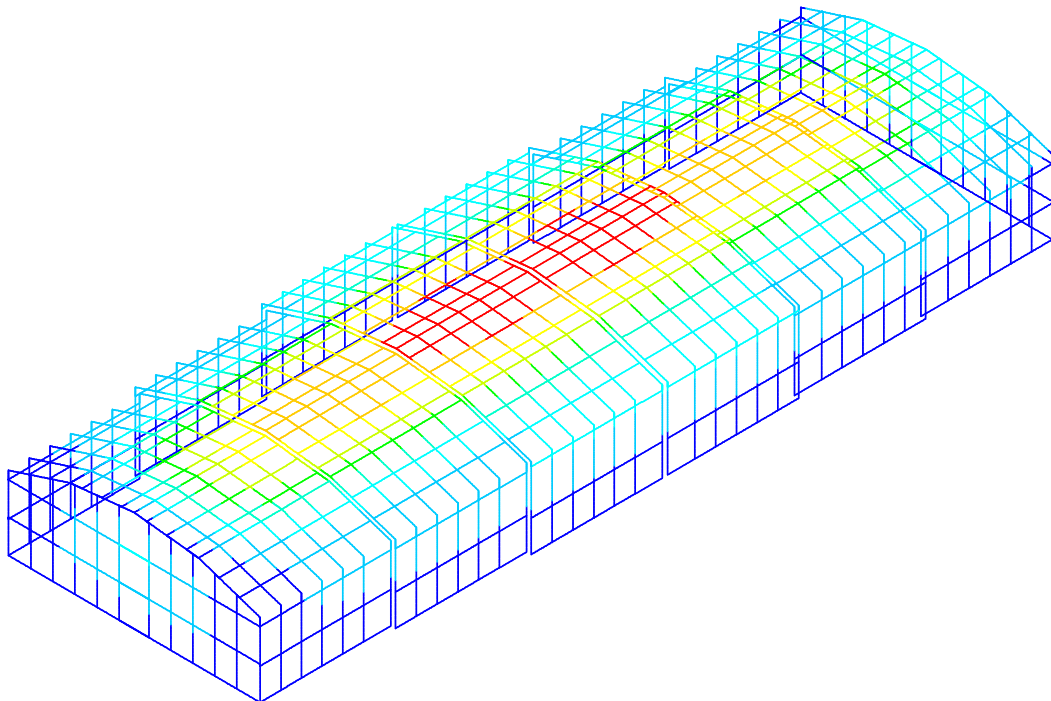
组合10 (恒0+0.6风2) Uxyz:mm (整体)



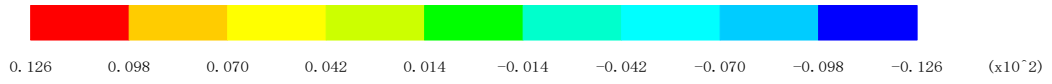
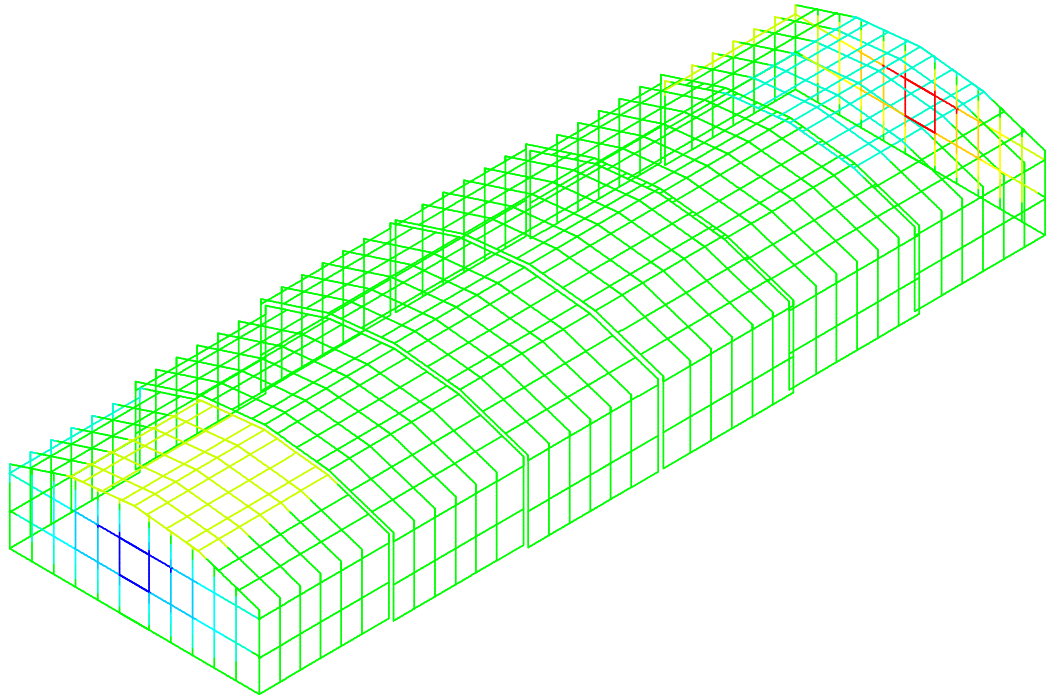
组合11 (恒0+0.6风3) Ux:mm (整体)



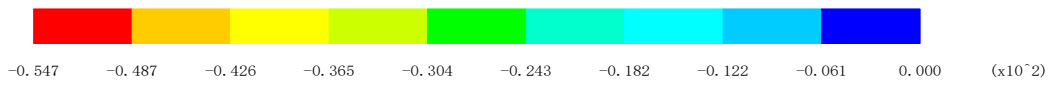
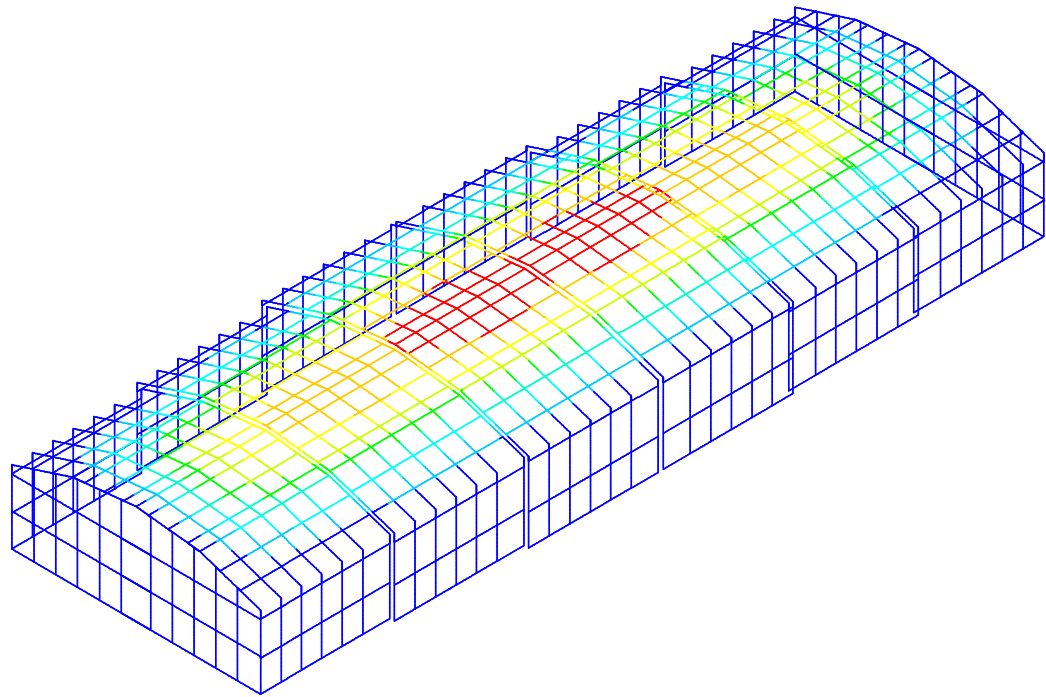
组合11 (恒0+0.6风3) Uz:mm (整体)



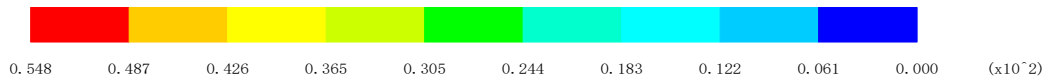
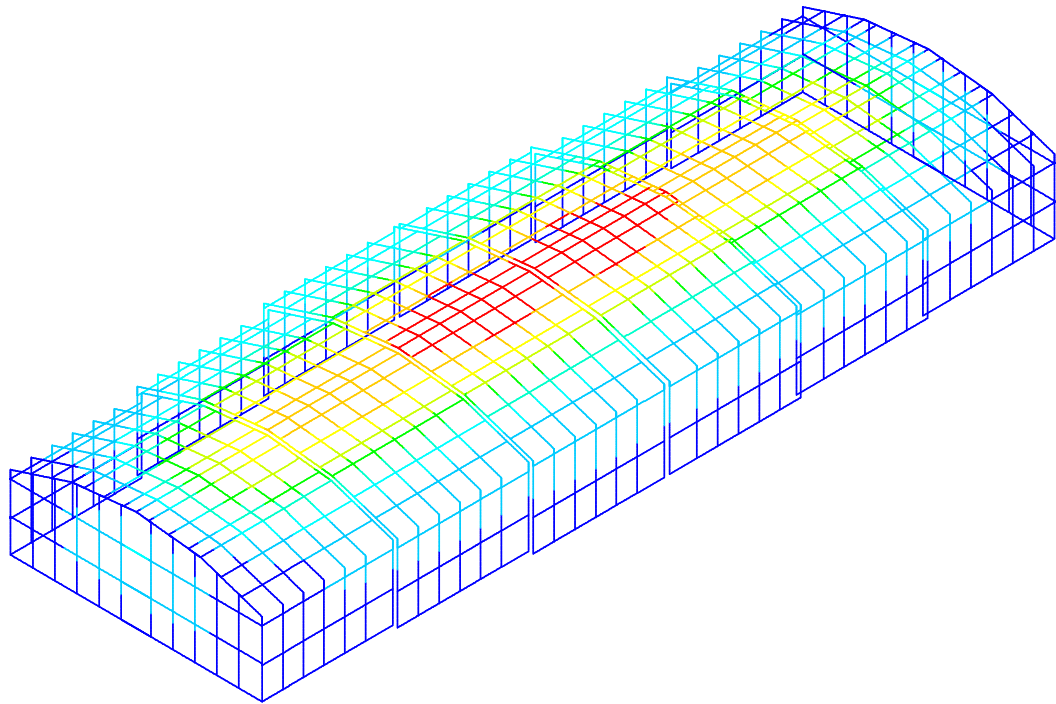
组合11 (恒0+0.6风3) Uxyz:mm (整体)



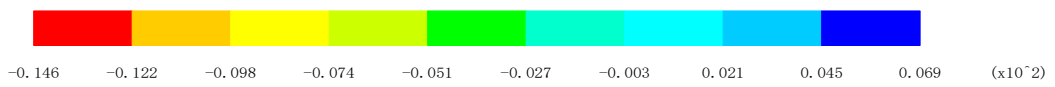
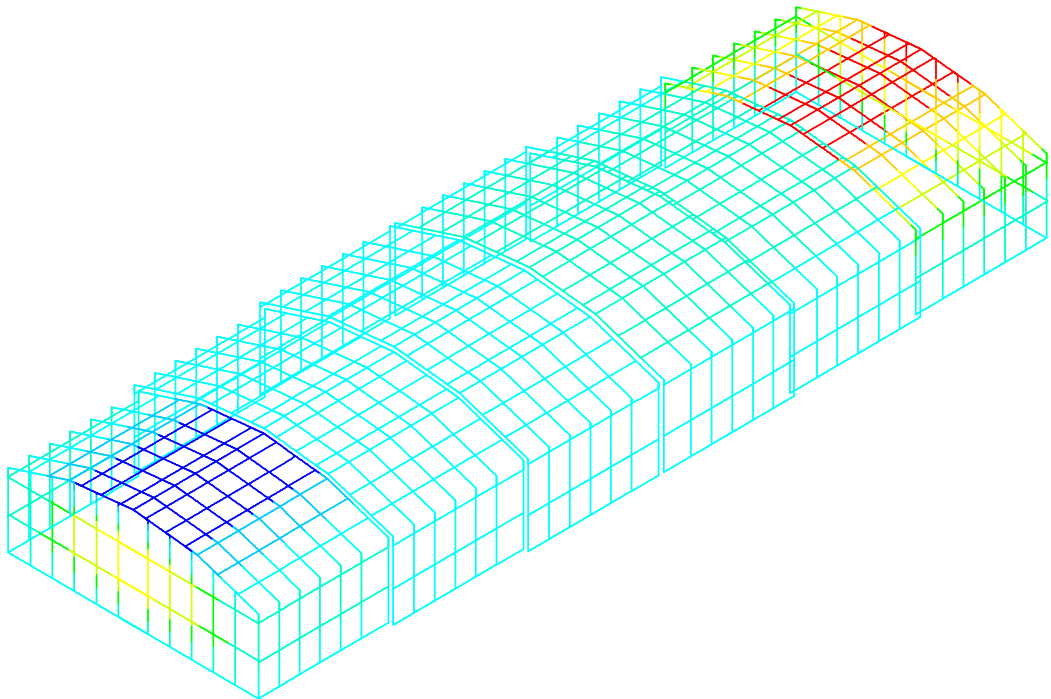
组合12 (恒0+0.7活1+0.6风2) Ux:mm (整体)



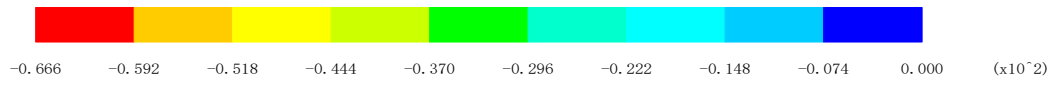
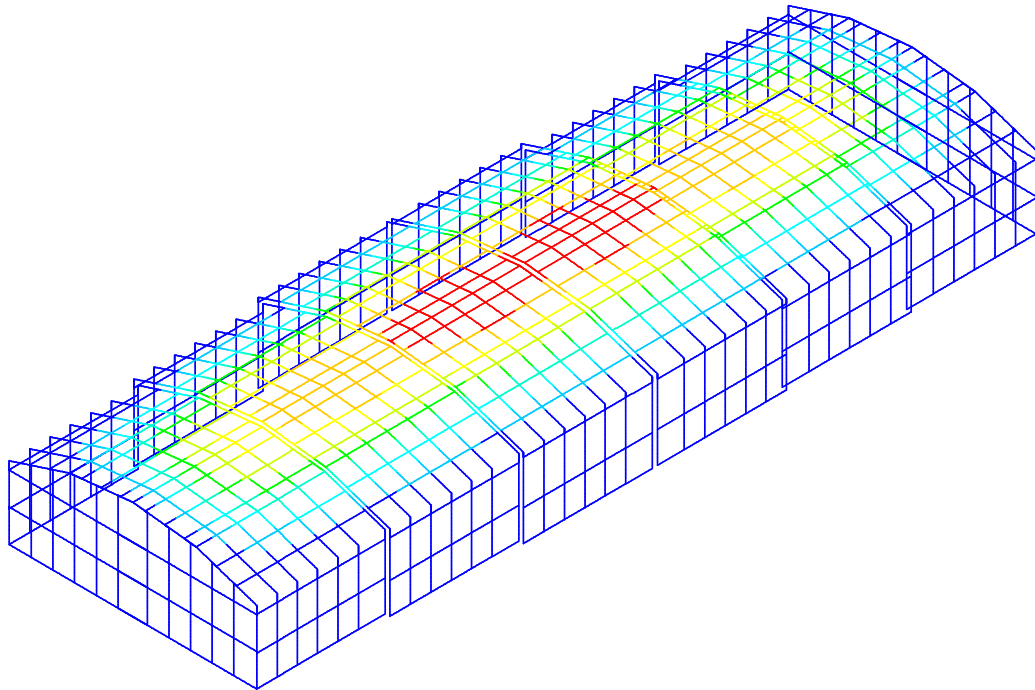
组合12 (恒0+0.7活1+0.6风2) Uz:mm (整体)



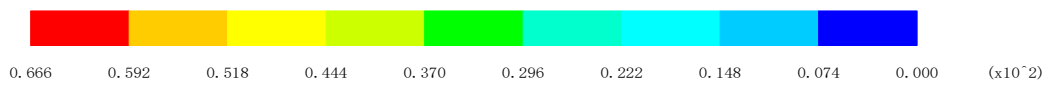
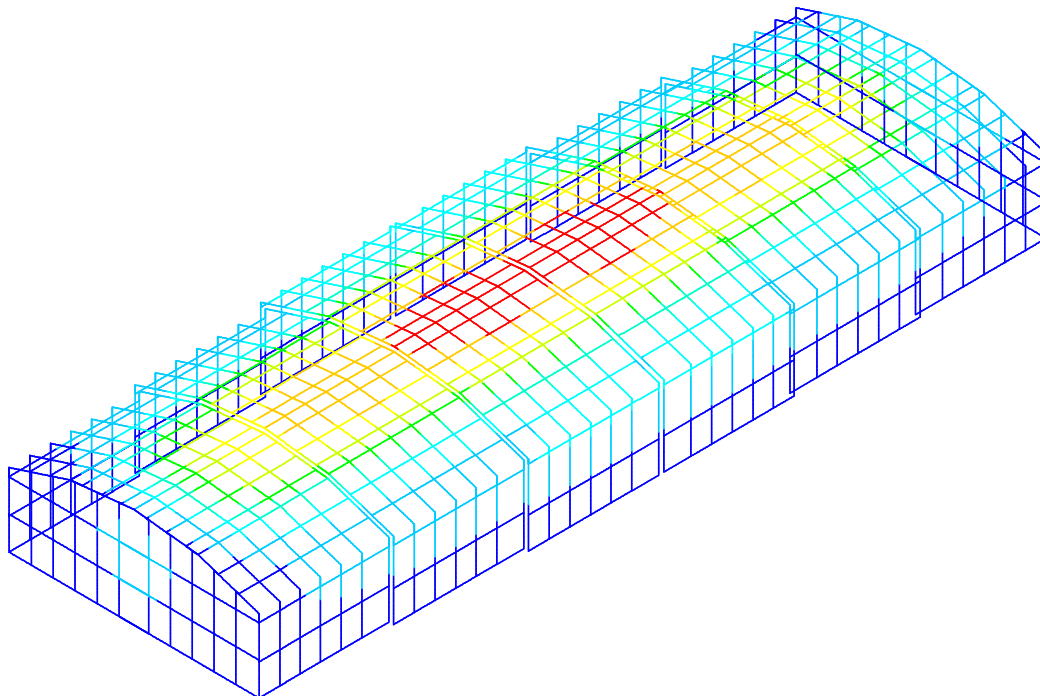
组合12 (恒0+0.7活1+0.6风2) Uxyz:mm (整体)



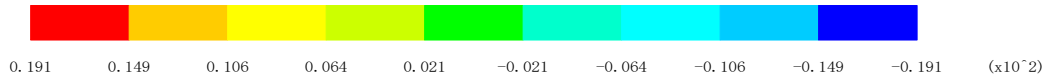
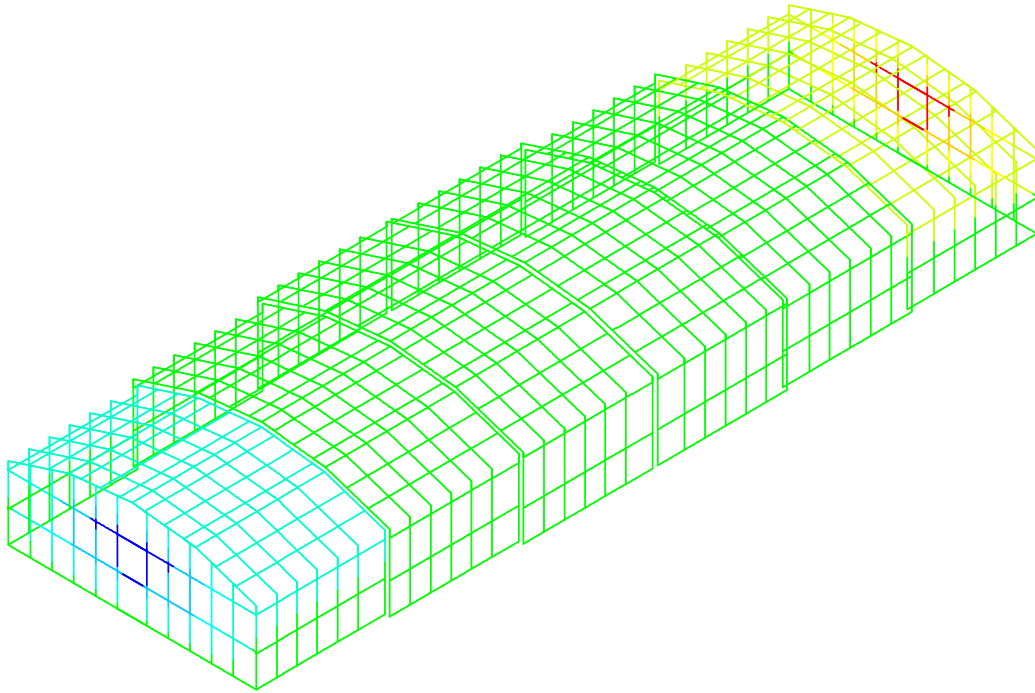
组合13 (恒0+0.7活1+0.6风3) Ux:mm (整体)



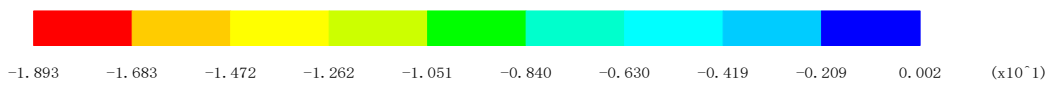
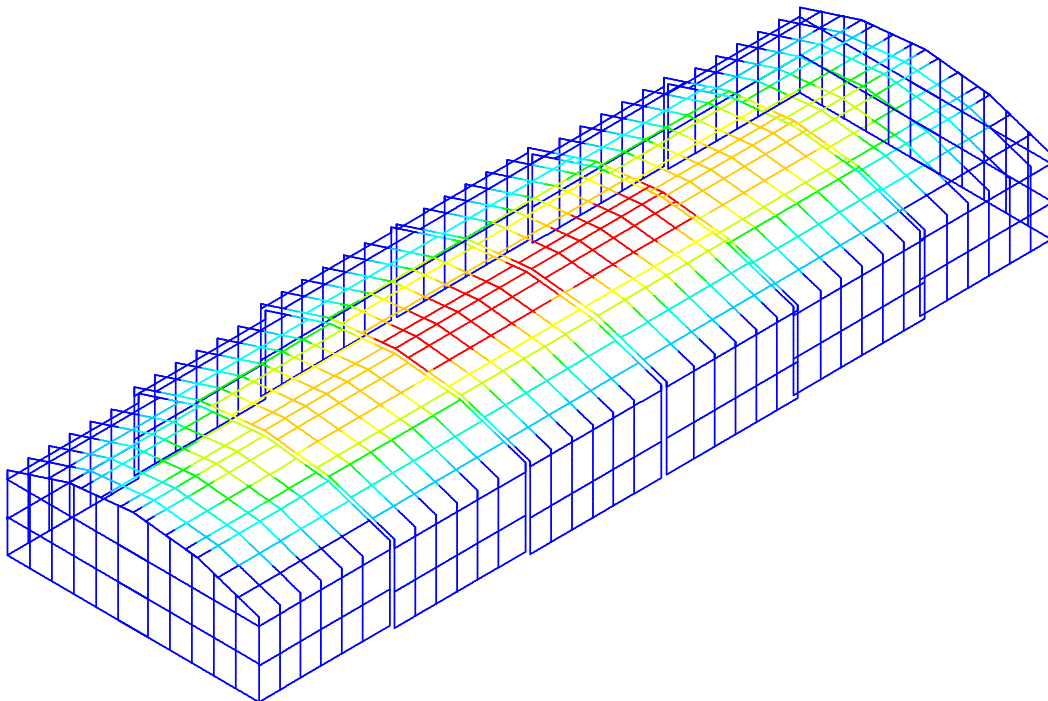
组合13 (恒0+0.7活1+0.6风3) Uz:mm (整体)



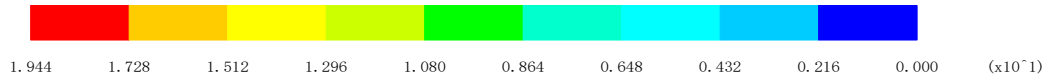
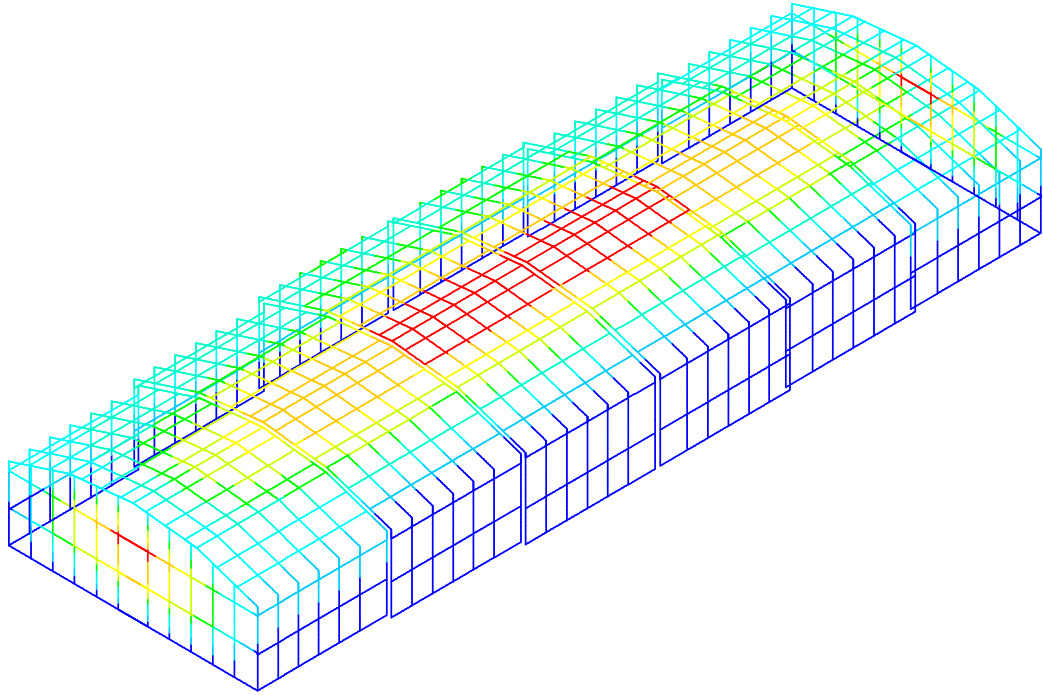
组合13 (恒0+0.7活1+0.6风3) Uxyz:mm (整体)



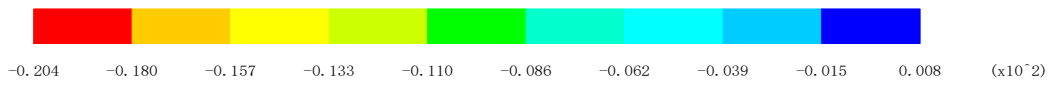
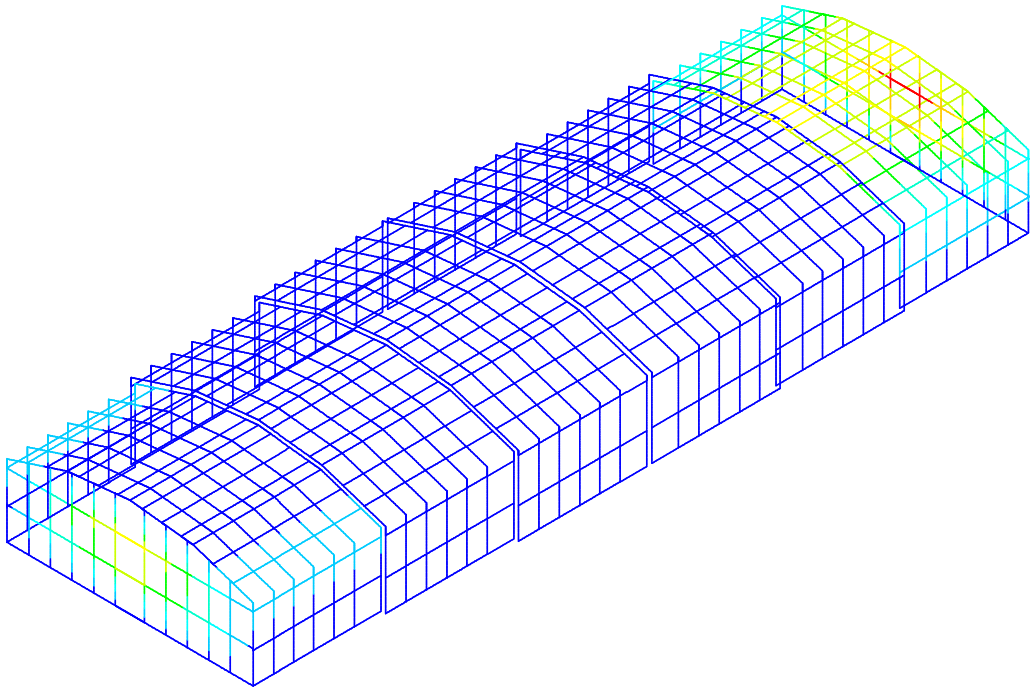
组合14 (恒0+风2) Ux:mm (整体)



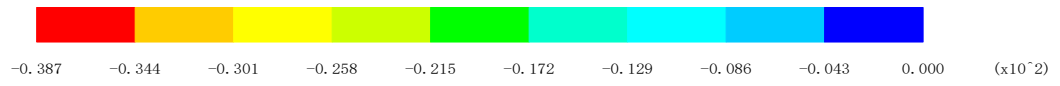
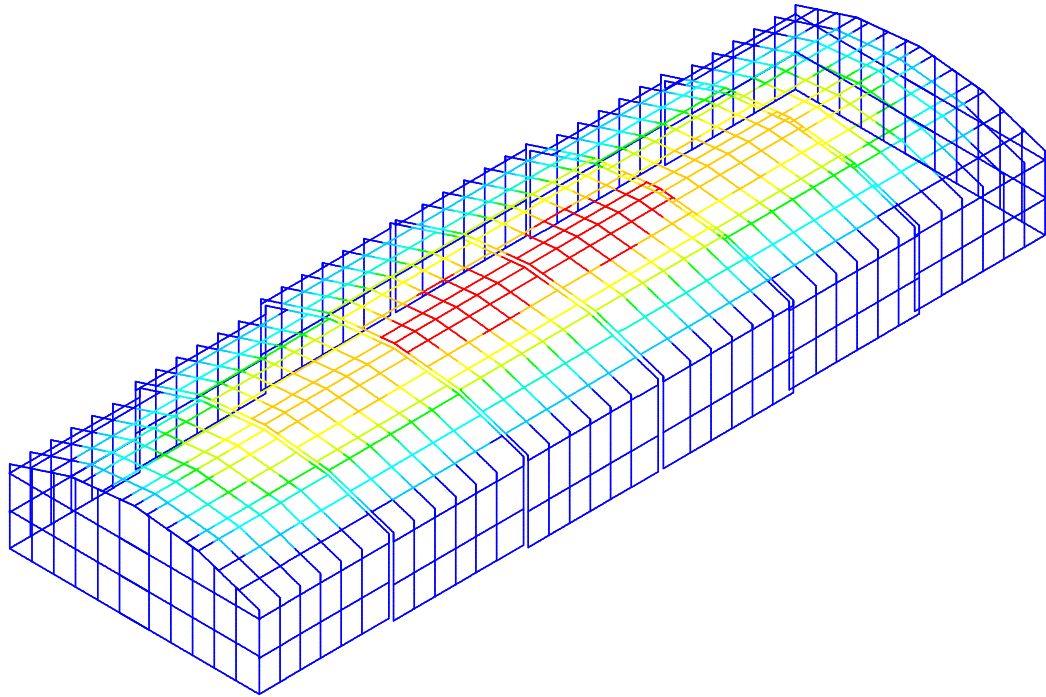
组合14 (恒0+风2) Uz:mm (整体)



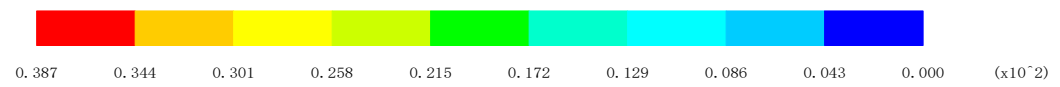
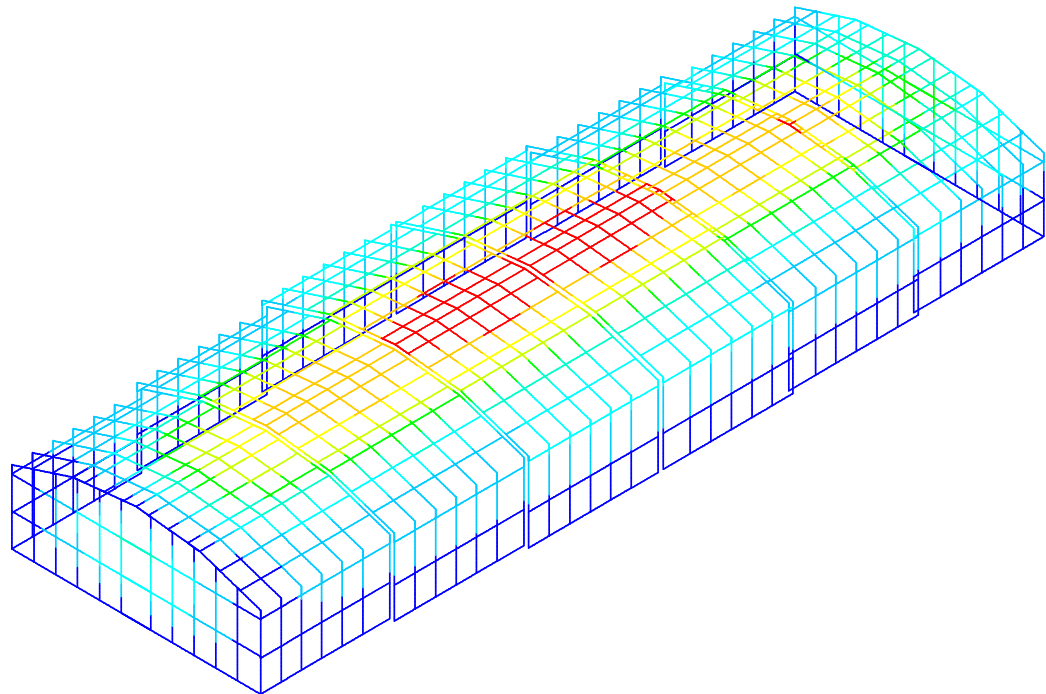
组合14 (恒0+风2) Uxyz:mm (整体)



组合15 (恒0+风3) Ux:mm (整体)

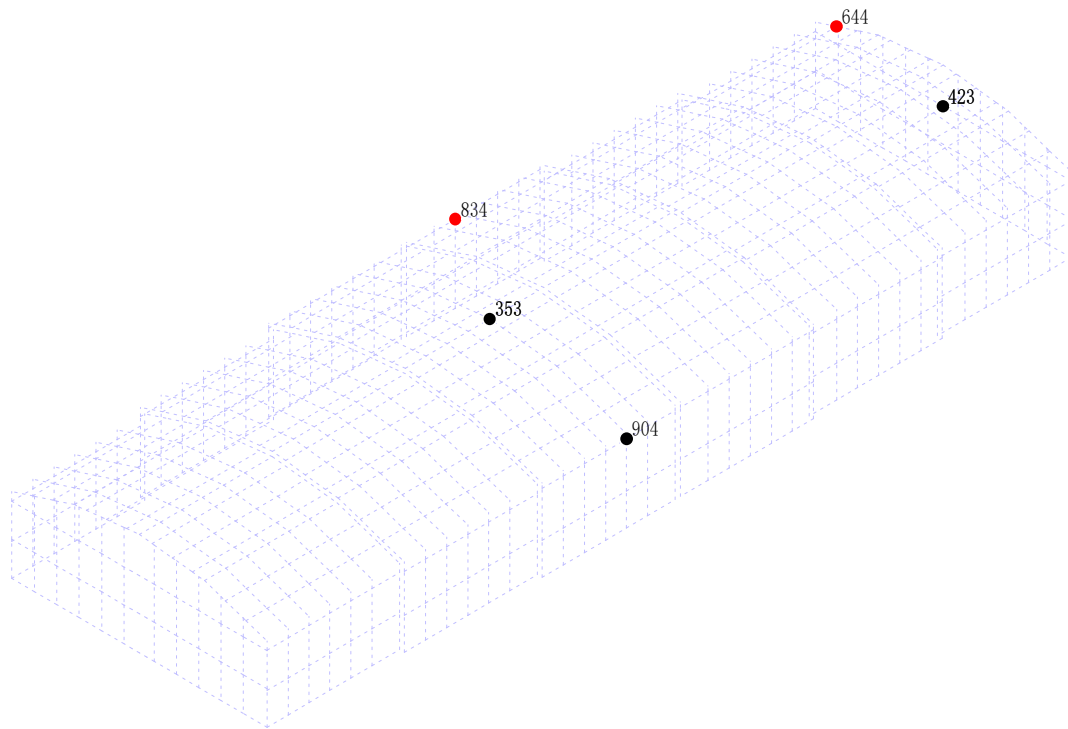


组合15 (恒0+风3) Uz:mm (整体)



组合15 (恒0+风3) Uxyz:mm (整体)

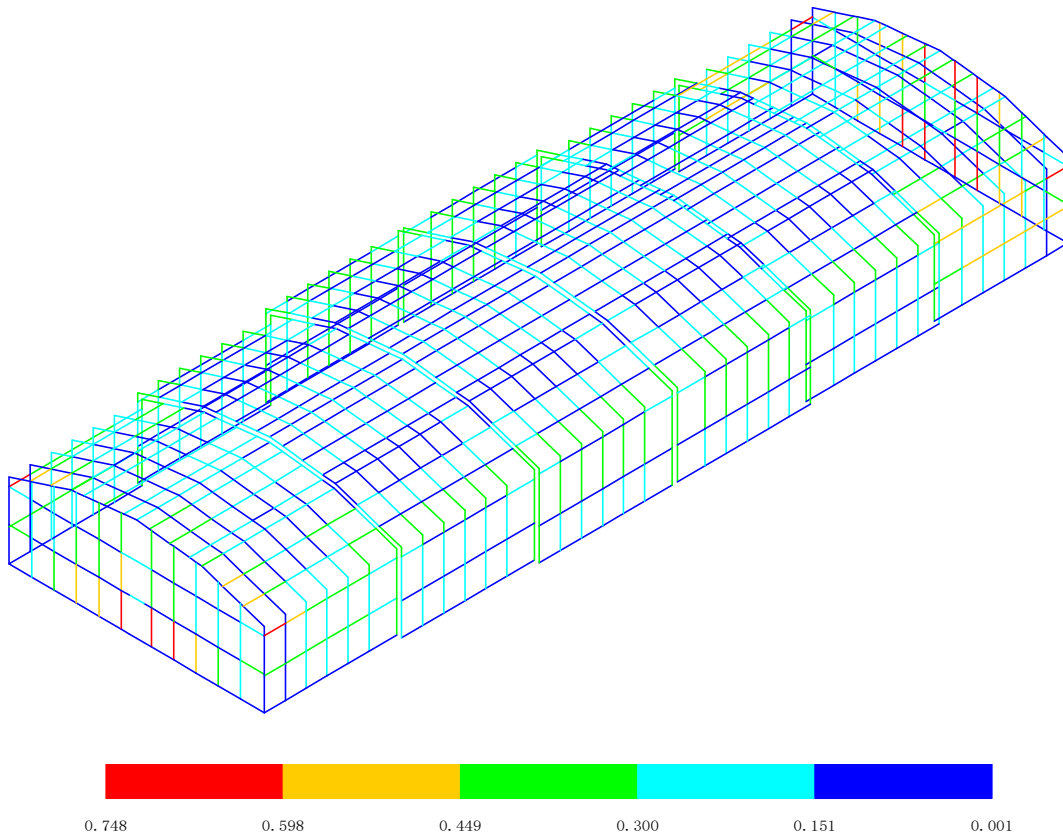
线性组合最大最小位移表						
最不利项	节点	组合名	U _x	U _y	U _z	U _{xyz}
X方向位移最大	423	组合7 (恒0+0.7活1+风2)	19.899	1.941	-0.383	19.997
Y方向位移最大	834	组合6 (恒0+活1+0.6风3)	-0.143	19.496	-0.096	19.497
Z方向位移最大	644	组合7 (恒0+0.7活1+风2)	3.354	2.267	0.027	4.048
空间位移最大	353	组合6 (恒0+活1+0.6风3)	1.202	0.014	-79.074	79.083
X方向位移最小	423	组合3 (恒0+风3)	-20.404	-0.002	-0.307	20.406
Y方向位移最小	904	组合6 (恒0+活1+0.6风3)	0.143	-19.474	-0.096	19.475
Z方向位移最小	353	组合6 (恒0+活1+0.6风3)	1.202	0.014	-79.074	79.083



线性组合最大最小位移图（整体）

7 设计验算

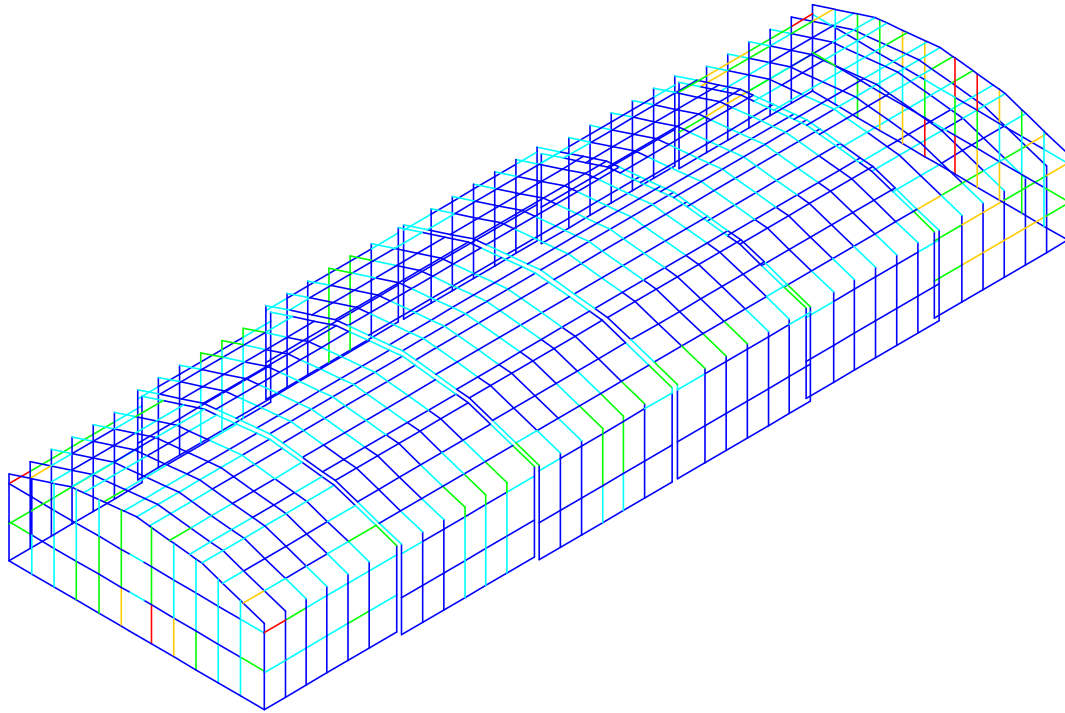
7.1 验算结果



按“强度应力比”显示构件颜色（整体）

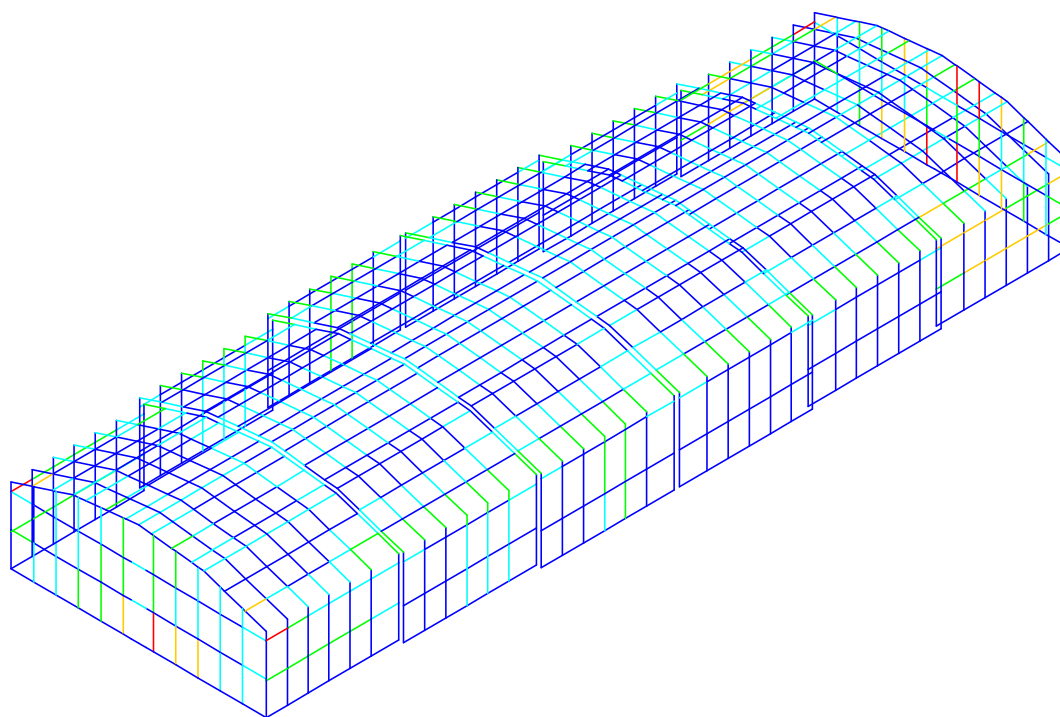
“强度应力比”最大的前 10 个单元的验算结果（所在组合号 / 情况号）									
序号	单元号	强度	绕2轴整体稳定	绕3轴整体稳定	沿2轴抗剪应力比	沿3轴抗剪力比	沿2轴长细比	沿3轴长细比	结果
1	704	0.748 (7/1)	-	-	0.001	0.016	67	72	满足
2	701	0.746 (8/1)	-	-	0.001	0.015	69	74	满足
3	1617	0.739 (6/1)	-	-	0.018	0.017	43	46	满足
4	508	0.738 (7/1)	-	-	0.001	0.016	67	72	满足
5	1605	0.732 (6/1)	-	-	0.017	0.017	43	46	满足
6	699	0.691 (3/1)	-	-	0.001	0.016	67	72	满足
7	513	0.653 (7/1)	-	-	0.001	0.015	67	72	满足
8	1417	0.652 (5/1)	-	-	0.017	0.021	43	46	满足

9	505	0.651 (7/1)	-	-	0.001	0.014	67	72	满足
10	707	0.649 (7/1)	-	-	0.001	0.014	67	72	满足



按“绕2轴稳定应力比”显示构件颜色（整体）

“绕2轴稳定应力比”最大的前10个单元的验算结果（所在组合号/情况号）									
序号	单元号	强度	绕2轴整体稳定	绕3轴整体稳定	沿2轴抗剪力比	沿3轴抗剪力比	沿2轴长细比	沿3轴长细比	结果
1	701	0.746	-	-	0.001	0.015	69	74	满足
2	1605	0.732	-	-	0.017	0.017	43	46	满足
3	699	0.691	-	-	0.001	0.016	67	72	满足
4	1617	0.739	-	-	0.018	0.017	43	46	满足
5	1417	0.652	-	-	0.017	0.021	43	46	满足
6	704	0.748	-	-	0.001	0.016	67	72	满足
7	698	0.627	-	-	0.000	0.014	64	69	满足
8	508	0.738	-	-	0.001	0.016	67	72	满足
9	702	0.649	-	-	0.001	0.015	69	74	满足
10	696	0.601	-	-	0.001	0.014	67	72	满足



按“绕3轴稳定应力比”显示构件颜色（整体）

“绕3轴稳定应力比”最大的前 10 个单元的验算结果（所在组合号 / 情况号）									
序号	单元号	强度	绕2轴整体 稳定	绕3轴整体 稳定	沿2轴抗剪应 力比	沿3轴抗剪应 力比	沿2轴长 细比	沿3轴 长细比	结果
1	701	0.746	-	-	0.001	0.015	69	74	满足
2	1605	0.732	-	-	0.017	0.017	43	46	满足
3	699	0.691	-	-	0.001	0.016	67	72	满足
4	1617	0.739	-	-	0.018	0.017	43	46	满足
5	1417	0.652	-	-	0.017	0.021	43	46	满足
6	704	0.748	-	-	0.001	0.016	67	72	满足
7	508	0.738	-	-	0.001	0.016	67	72	满足
8	698	0.627	-	-	0.000	0.014	64	69	满足
9	702	0.649	-	-	0.001	0.015	69	74	满足
10	1405	0.646	-	-	0.016	0.021	43	46	满足

8. 结论

通过以上计算结果可得结论如下：

1. 结构体系合理可行。
2. 结构在标准组合下结构最大位移为79mm，恒载情况下，结构最大跨中挠度38mm。满足结构刚度要求。
3. 结构在标准组合下结构柱顶侧向位移小于 $H/75$ （ H 为柱高），满足侧向刚度要求。
4. 钢结构构件强度和稳定验算结果均满足《钢结构设计规范》（GB50017-2017）要求。
5. 铝合金构件强度和稳定验算结果均满足《铝合金格构结构技术规程》（DGJ 08-95-2000）要求。
6. 阳光房滑动轨迹可容许最大变形请根据实际情况评定，此计算书的最大变形仅对刚度的进行验算。