
U3阳光房阳光房计算书

工程编号: _____

项目名称: _____

专业设计: _____

计 算: _____

校 对: _____

审 核: _____

日 期: _____

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1 工程简介

U3阳光房阳光房如图1，纵向长13m，最大刚架跨度为9.6m，刚架间距约为1.3m，分小中大五跨，共有11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 2021.1.0（上海同磊土木工程技术有限公司）

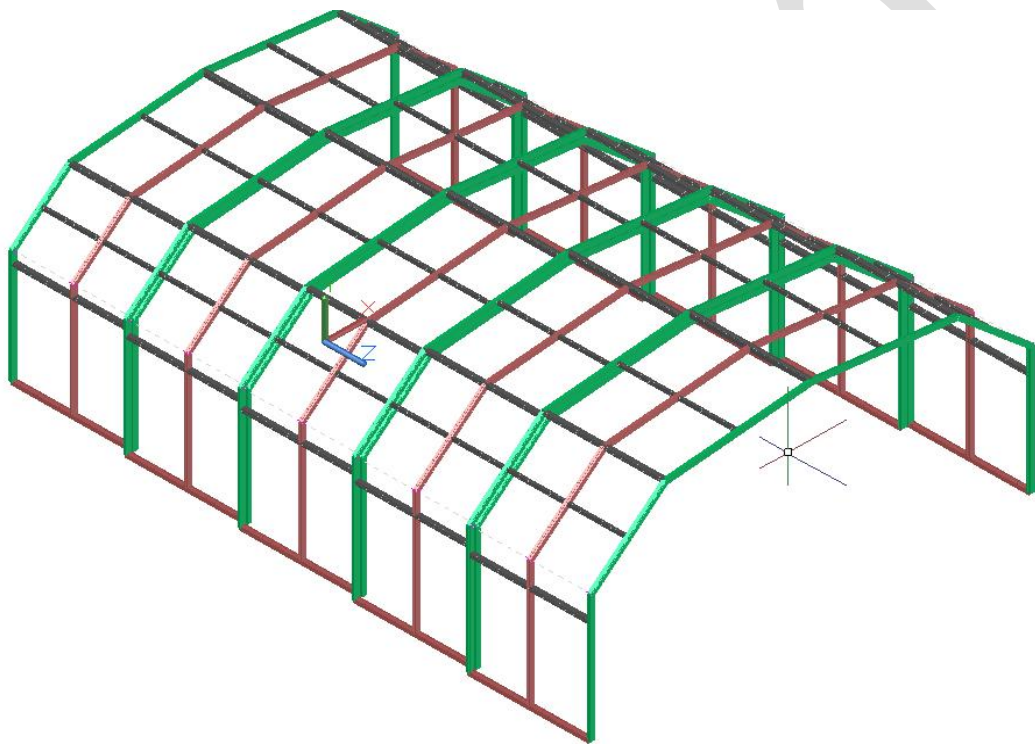


图1 阳光房结构轴侧图

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)

《门式刚架轻型房屋钢结构技术规程》

(CECS102: 2002)

3 计算简图

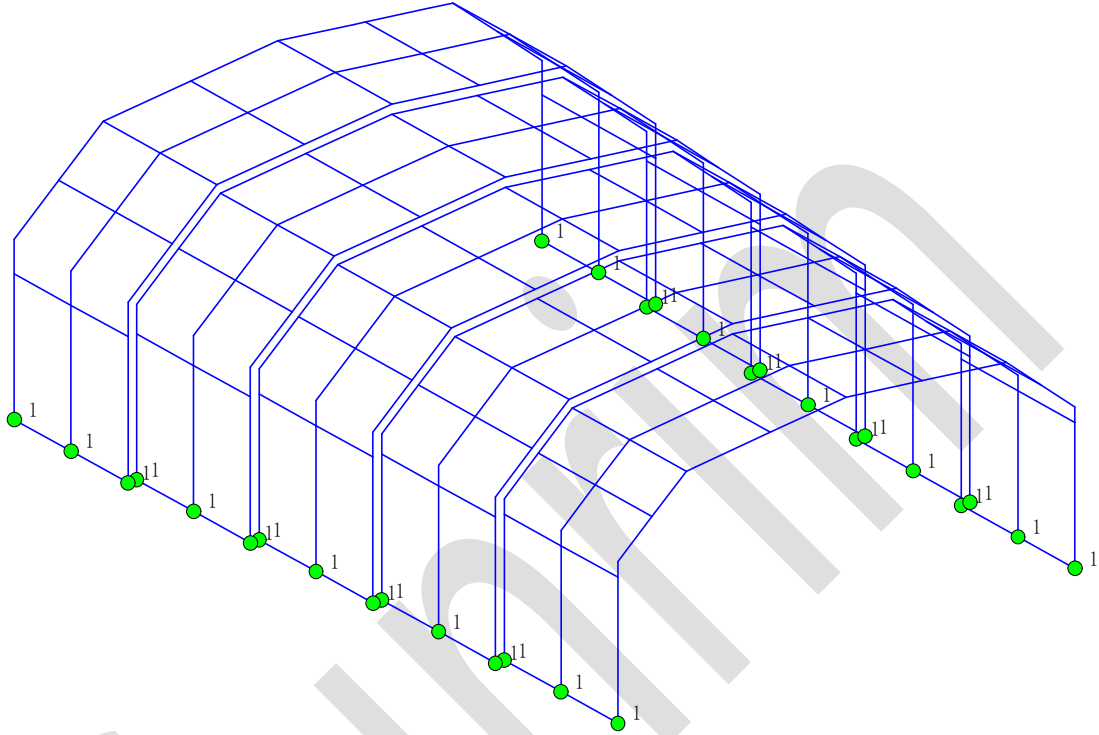


图2 U3阳光房阳光房结构计算简图

4 主刚架计算模型

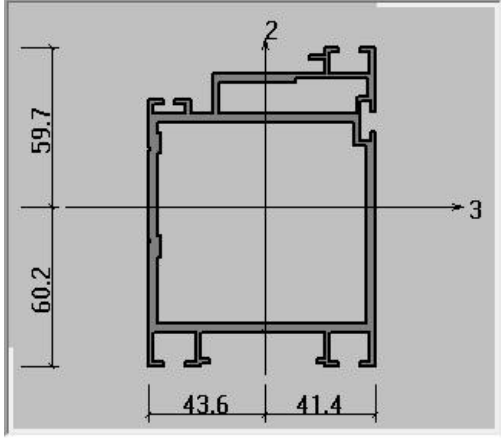
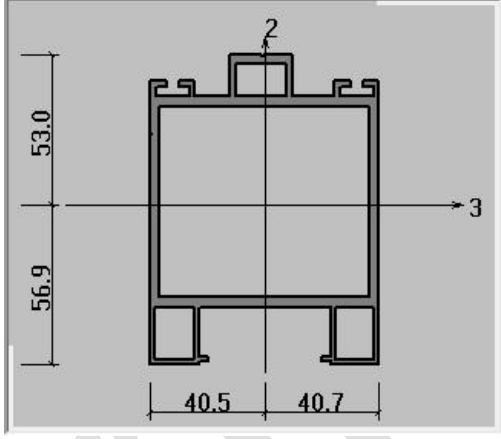
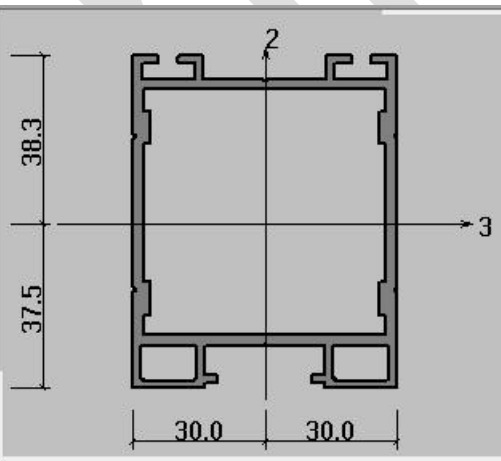
主体架构有三种材料，材料属性如表1，杆件截面如表2，单元信息表如表3。

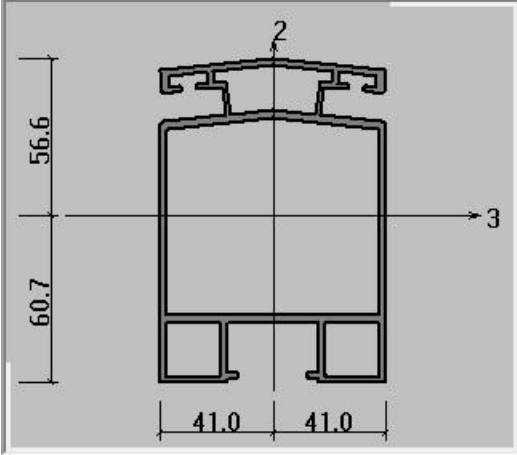
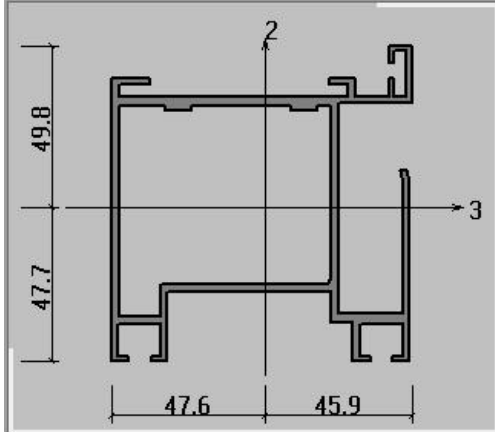
表1，材料属性表

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
----	------	----

1		<p>铝合金 6061-T6</p>
2		<p>铝合金 6063-T6</p>
3		<p>铝合金 6063-T6</p>

4		铝合金 6063-T5
5		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，高度在6层楼高，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:取上海地区100年一遇风载(0.6KN/m²)

3) 雪荷载:取上海地区100年一遇雪载(0.4KN/m²)

5.1 荷载组合

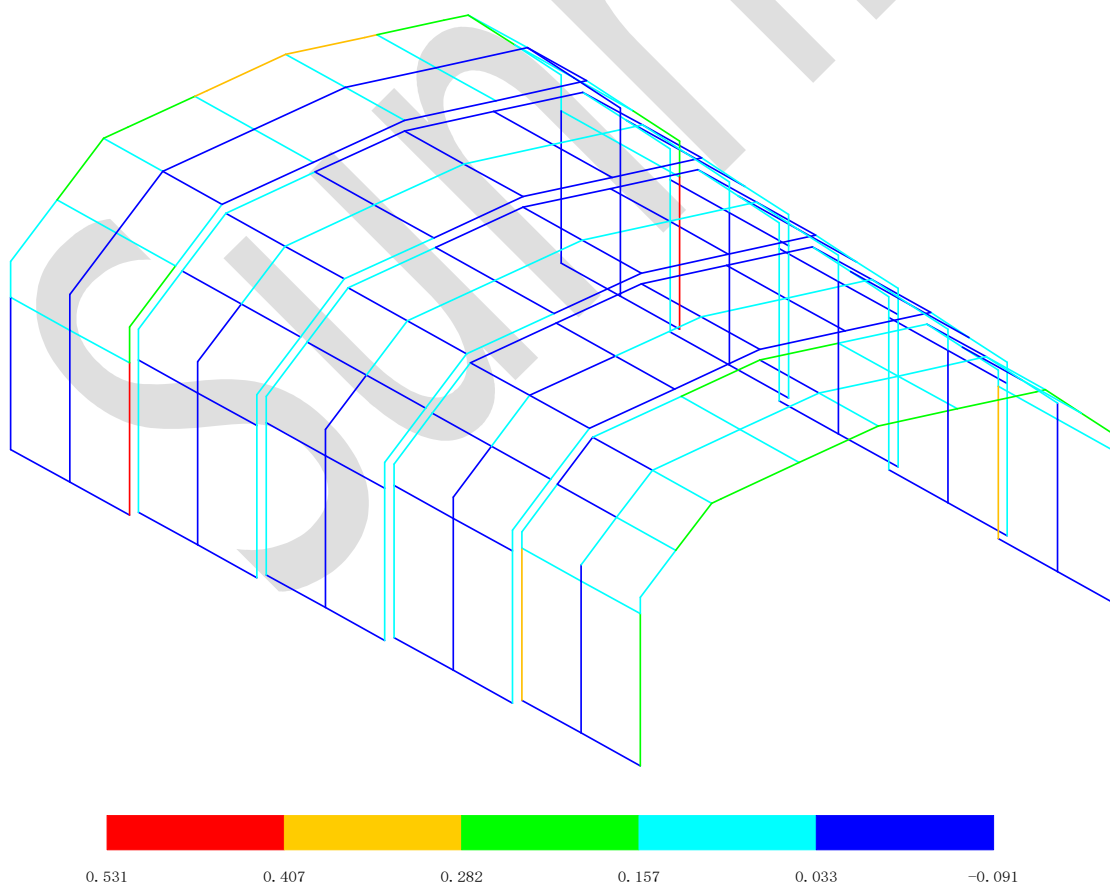
- (1) 1.300 恒载 + 1.50风载2
- (2) 1.300 恒载 + 1.50风载3
- (3) 1.300 恒载 + 1.50风载4
- (4) 1.300 恒载 + 1.500 雪
- (5) 1.300 恒载 + 1.50 x 0.60风载2 + 1.500 雪

-
- (6) 1.300 恒载 + 1.50 x 0.60风载3 + 1.500 雪
 - (7) 1.300 恒载 + 1.50 x 0.60风载4 + 1.500 雪
 - (8) 1.300 恒载 + 1.50风载2 + 1.500 x 0.700 雪
 - (9) 1.300 恒载 + 1.50风载3 + 1.500 x 0.700 雪
 - (10) 1.300 恒载 + 1.50风载4 + 1.500 x 0.700 雪
 - (11) 1.000 恒载 + 1.50风载2
 - (12) 1.000 恒载 + 1.50风载3
 - (13) 1.000 恒载 + 1.50风载4

6 内力位移计算结果

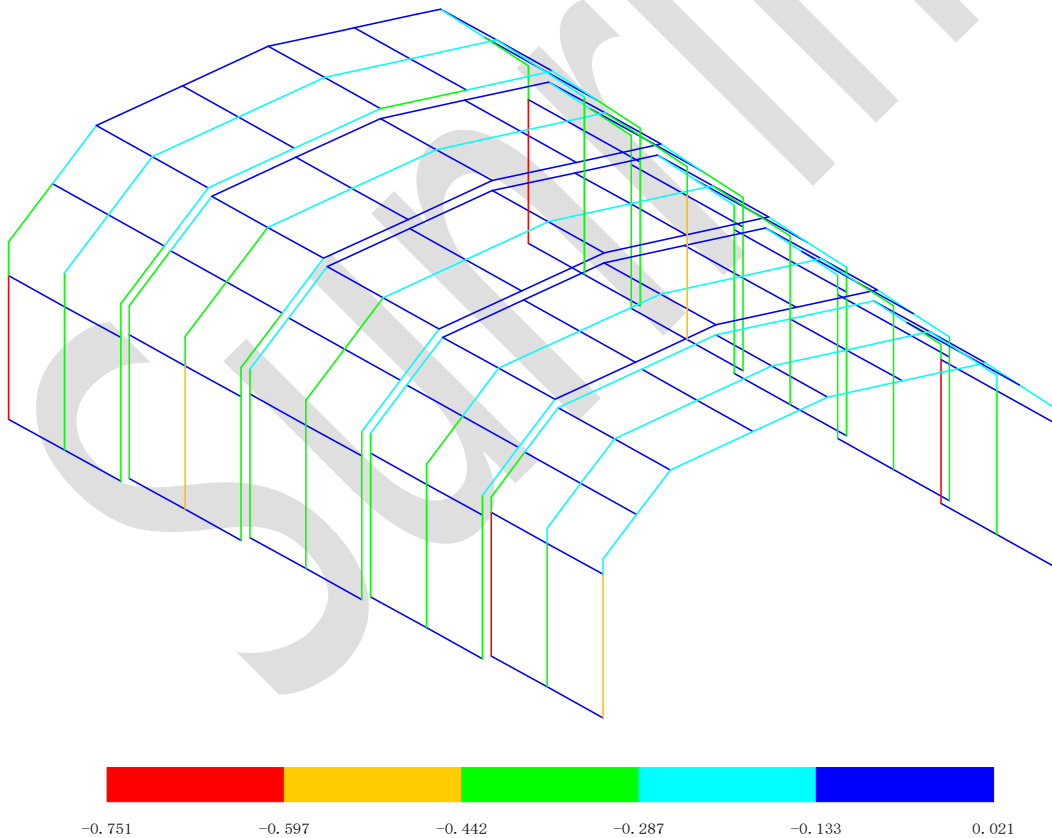
6.1 内力

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)

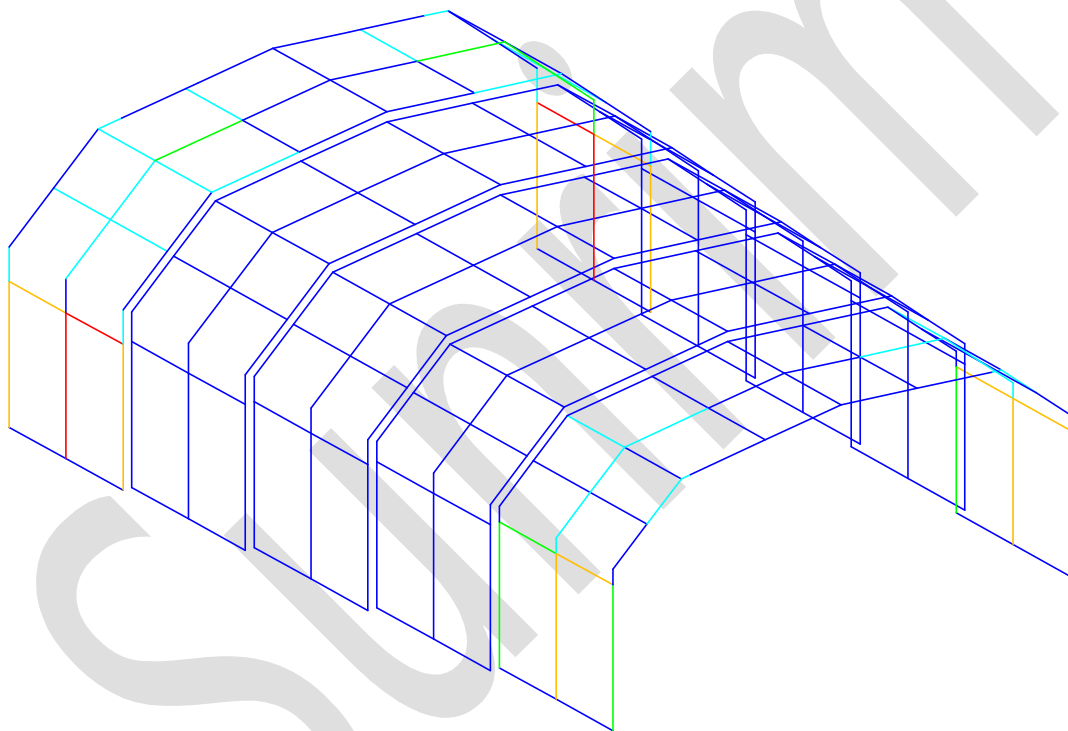
轴力N最大的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	339	13	1	2.277	5.314	0.289	-1.495	0.238	-1.666	-0.504
2	12	11	1	0.000	5.064	-0.187	1.501	-0.202	-1.677	-0.305
3	269	13	1	2.277	3.390	0.140	1.104	-0.102	1.270	-0.245
4	282	11	1	0.000	3.157	-0.039	-1.110	0.078	1.281	-0.041
5	18	11	1	1.377	3.078	-0.095	-0.017	-0.308	-0.242	-0.038
6	45	13	1	0.000	3.005	0.121	0.024	0.351	-0.253	-0.011
7	17	11	1	0.214	2.952	0.759	-1.111	0.052	-0.263	-0.072
8	46	13	1	0.000	2.821	-1.013	1.133	-0.054	-0.270	-0.085
9	15	8	1	0.428	2.807	-3.376	-1.002	0.405	0.017	1.028
10	48	10	1	0.000	2.634	3.123	1.026	-0.326	0.018	0.992



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	21	3	1	0.000	-7.520	-1.178	-1.519	0.185	1.810	-1.463

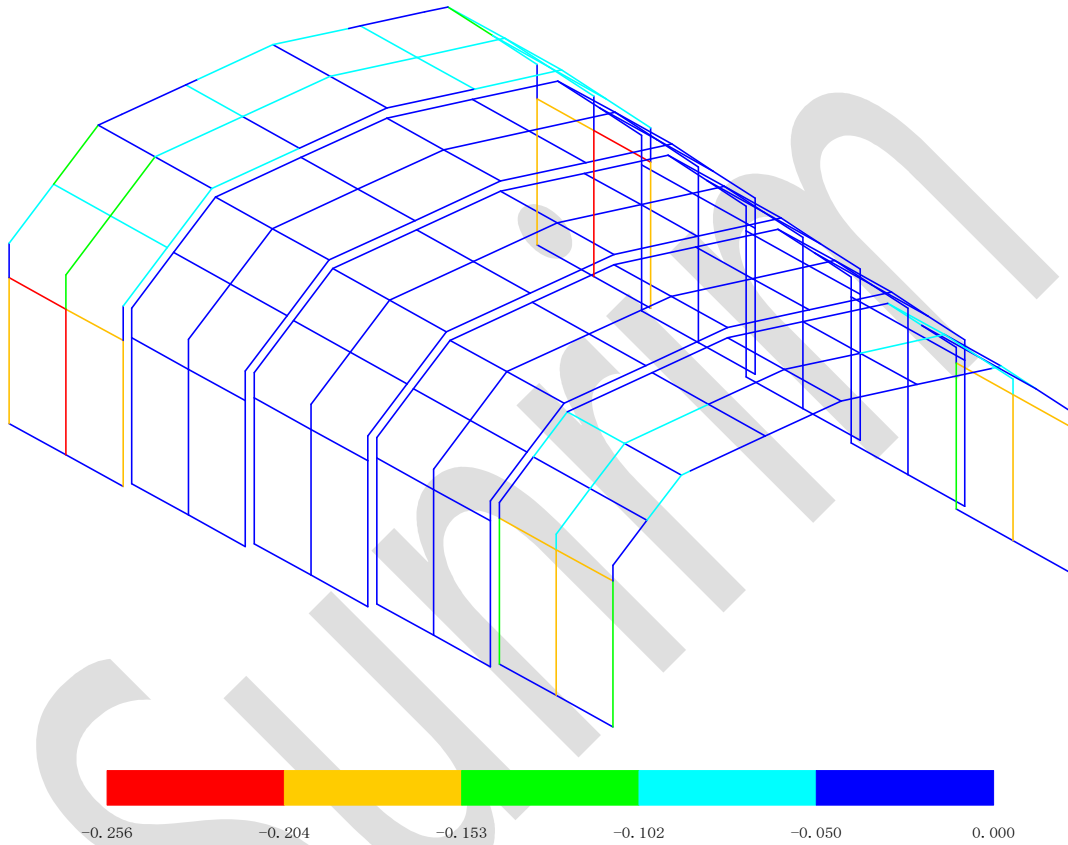
2	52	1	1	2.277	-7.513	1.214	1.525	-0.148	1.814	-1.503
3	269	9	1	0.000	-6.164	-1.175	-1.126	0.247	1.294	-0.263
4	282	9	1	2.277	-6.164	1.175	1.126	-0.247	1.295	-0.263
5	258	1	1	2.277	-5.452	1.115	-1.152	0.049	-1.330	-1.256
6	228	3	1	0.000	-5.422	-1.076	1.146	-0.076	-1.327	-1.215
7	181	4	1	0.000	-4.427	-1.032	0.000	-0.000	-0.000	-0.019
8	175	4	1	0.000	-4.427	-1.032	-0.000	0.000	0.000	-0.019
9	339	4	1	0.000	-4.305	-1.013	0.001	-0.296	-0.043	-0.303
10	12	4	1	2.277	-4.305	1.013	-0.001	0.296	-0.043	-0.303



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	138	13	1	1.317	0.621	0.527	3.458	-0.071	2.580	-0.295
2	135	11	1	0.000	0.410	0.038	-3.290	0.021	2.460	0.090
3	163	13	1	0.000	0.048	-0.184	-2.111	0.197	2.444	-0.196
4	169	11	1	2.277	0.042	-0.225	2.112	-0.159	2.365	0.306

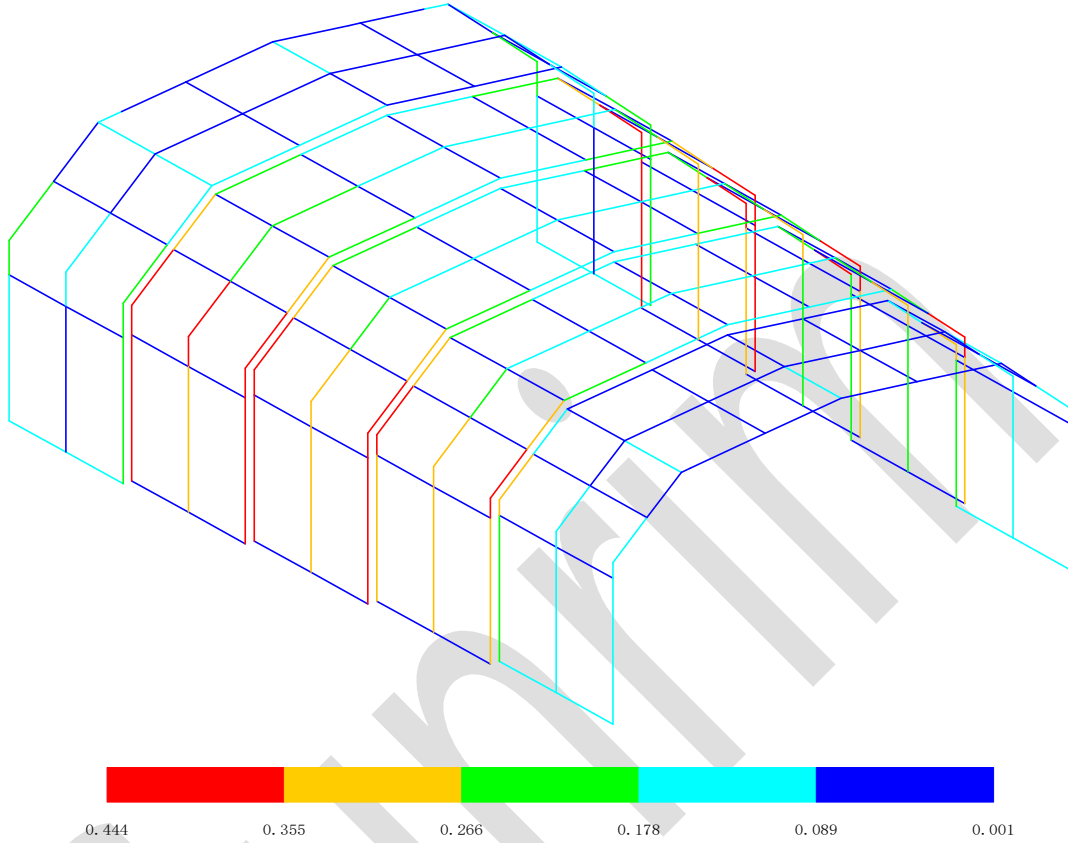
5	136	11	1	0.000	0.624	0.604	-3.395	0.056	1.937	0.433
6	137	13	1	1.318	0.405	-0.009	3.353	-0.035	1.912	0.054
7	52	11	1	2.277	-7.347	1.222	1.524	-0.170	1.816	-1.515
8	21	13	1	0.000	-7.355	-1.187	-1.518	0.207	1.812	-1.475
9	211	9	1	0.000	-1.922	-0.457	-1.562	0.268	1.803	-0.047
10	217	9	1	2.277	-1.811	-0.457	1.562	-0.268	1.755	0.994



线性组合弯矩M2最小包络云图:kN.m (整体)

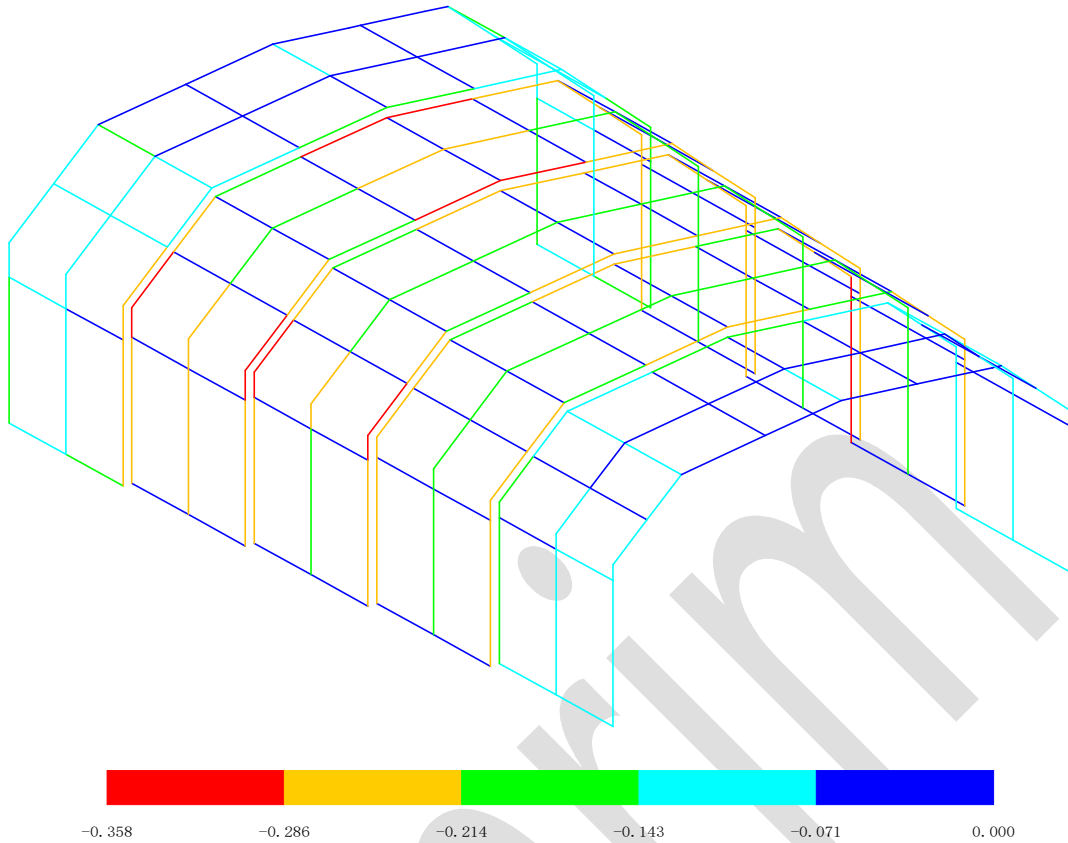
弯矩M2最小的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	136	11	1	1.317	0.624	0.604	-3.445	0.056	-2.568	-0.362
2	137	13	1	0.000	0.405	-0.009	3.303	-0.035	-2.473	0.042
3	169	11	1	0.000	-0.044	-0.225	2.112	-0.159	-2.446	-0.205
4	163	13	1	2.277	0.134	-0.184	-2.111	0.197	-2.364	0.224
5	138	13	1	0.000	0.621	0.527	3.408	-0.071	-1.942	0.399
6	135	11	1	1.318	0.410	0.038	-3.340	0.021	-1.907	0.040
7	217	9	1	0.000	-1.923	-0.457	1.562	-0.268	-1.803	-0.047

8	211	9	1	2.277	-1.810	-0.457	-1.562	0.268	-1.755	0.994
9	64	9	1	1.318	-0.216	0.135	-2.357	-0.054	-1.739	0.041
10	69	9	1	0.000	-0.139	-0.274	2.290	0.080	-1.724	-0.221



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	13	5	1	0.000	-3.263	1.268	0.062	-0.069	0.001	4.435
2	327	5	1	0.000	-3.263	1.268	-0.062	0.069	-0.001	4.435
3	10	5	1	0.995	-2.889	-1.553	0.062	-0.043	0.053	4.435
4	324	5	1	0.995	-2.889	-1.553	-0.062	0.043	-0.053	4.435
5	304	5	1	0.389	-3.136	-1.201	-0.072	0.072	0.004	4.144
6	329	5	1	0.000	-3.136	1.201	0.072	-0.072	0.004	4.144
7	300	5	1	0.934	-2.771	-1.506	-0.072	0.043	-0.057	4.144
8	326	5	1	0.934	-2.771	-1.506	0.072	-0.043	0.057	4.144
9	2	7	1	0.462	-3.098	-1.160	-0.061	0.068	0.000	4.126
10	316	7	1	0.462	-3.098	-1.160	0.061	-0.068	-0.000	4.126

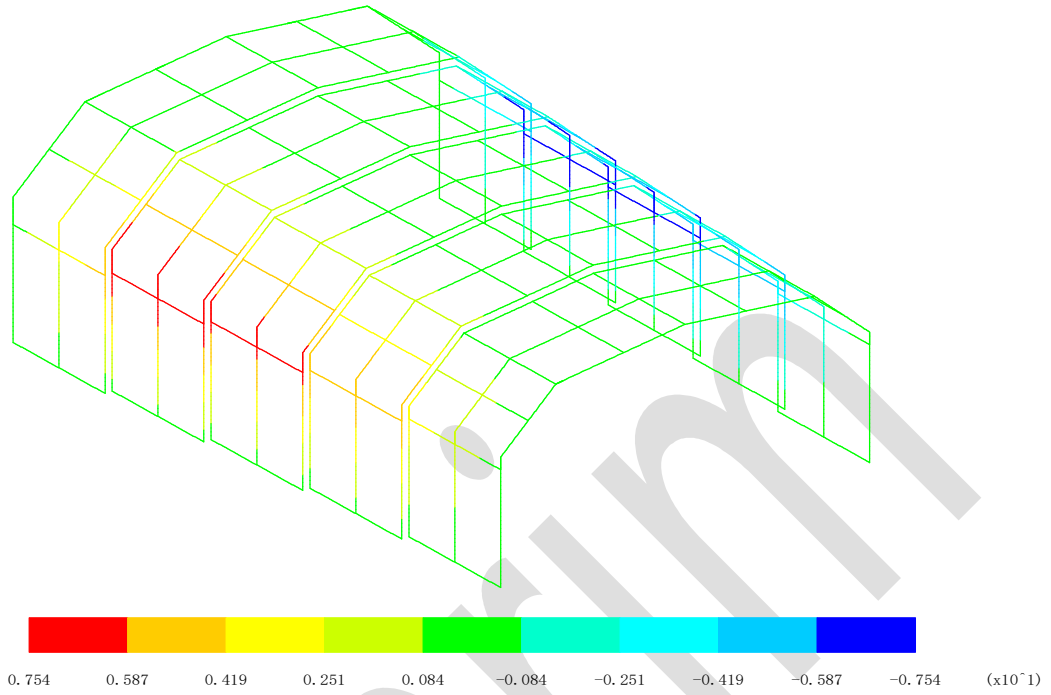


线性组合弯矩M3最小包络云图:kN.m (整体)

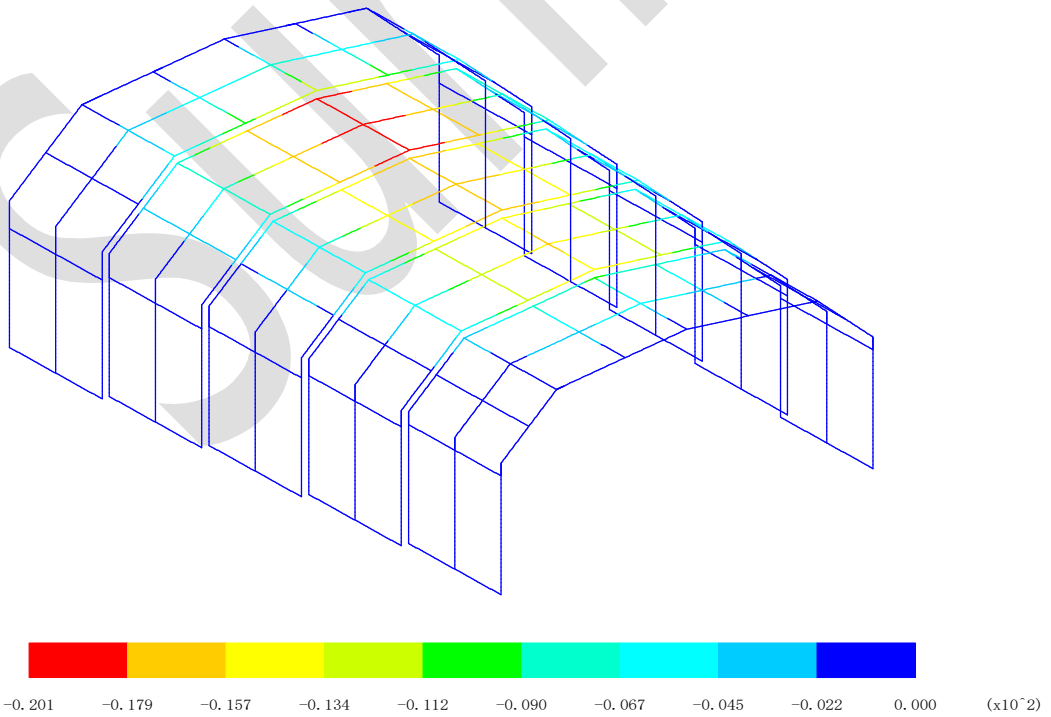
弯矩M3最小的前10个单元的内力 (单位: m, kN, kN.m)										
序号	单元号	组合号	组合序号	位置	轴力N	剪力Q2	剪力Q3	扭矩M	弯矩M2	弯矩M3
1	294	7	1	0.316	-2.854	1.034	0.082	0.074	-0.006	-3.586
2	293	7	1	2.277	-3.036	1.423	-0.003	-0.021	-0.007	-3.253
3	13	13	1	0.000	0.862	-0.627	-0.032	0.033	-0.009	-3.130
4	327	13	1	0.000	0.862	-0.627	0.032	-0.033	0.009	-3.130
5	10	13	1	0.995	1.005	0.399	-0.032	0.014	-0.031	-3.130
6	324	13	1	0.995	1.005	0.399	0.032	-0.014	0.031	-3.130
7	5	6	1	0.000	-0.742	-0.531	0.060	-0.004	-0.062	-3.025
8	334	6	1	1.559	-0.742	0.531	-0.060	0.004	-0.062	-3.025
9	308	6	1	1.559	-0.742	0.531	0.060	-0.004	0.062	-3.025
10	319	6	1	0.000	-0.742	-0.531	-0.060	0.004	0.062	-3.025

6.2 位移

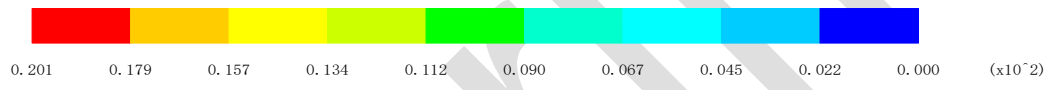
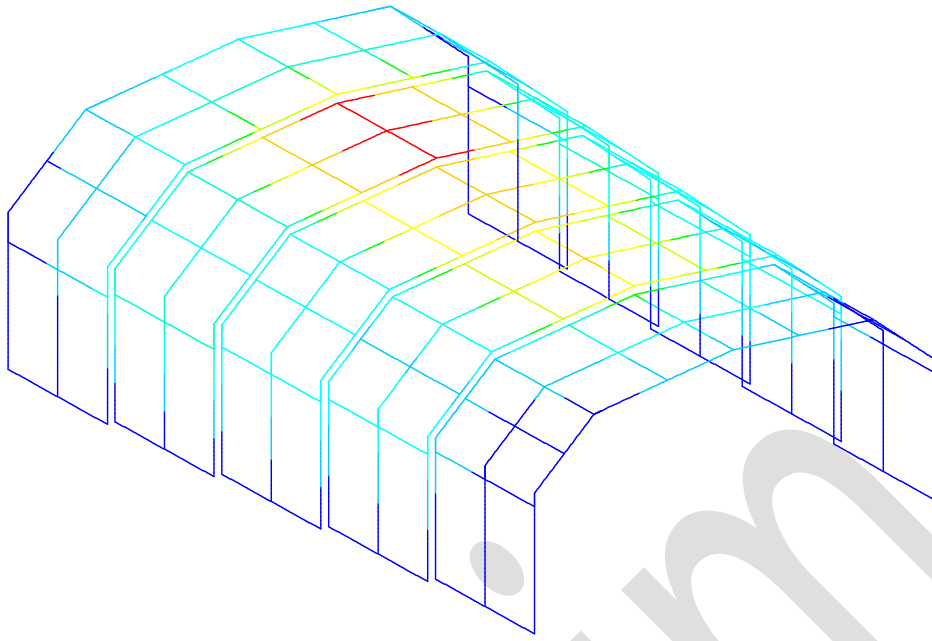
6.2.1 位移计算结果



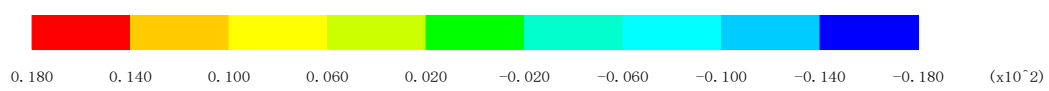
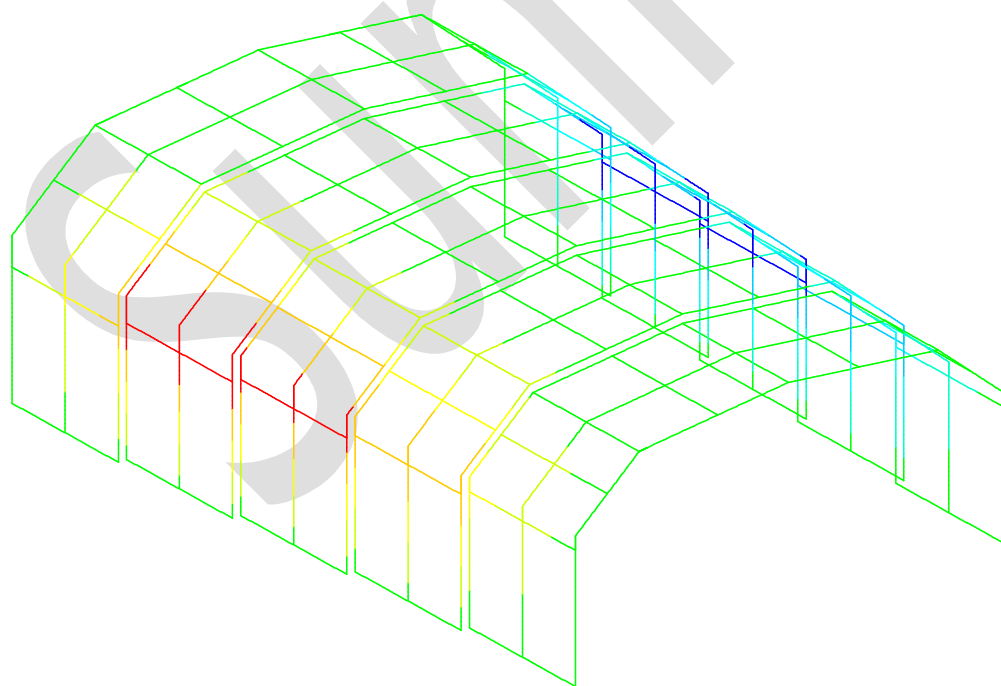
恒载工况 U_x :mm (整体)



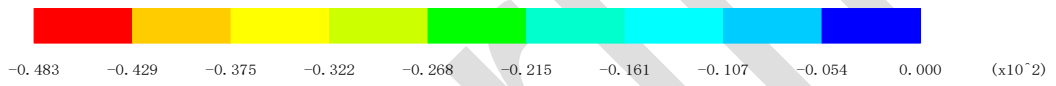
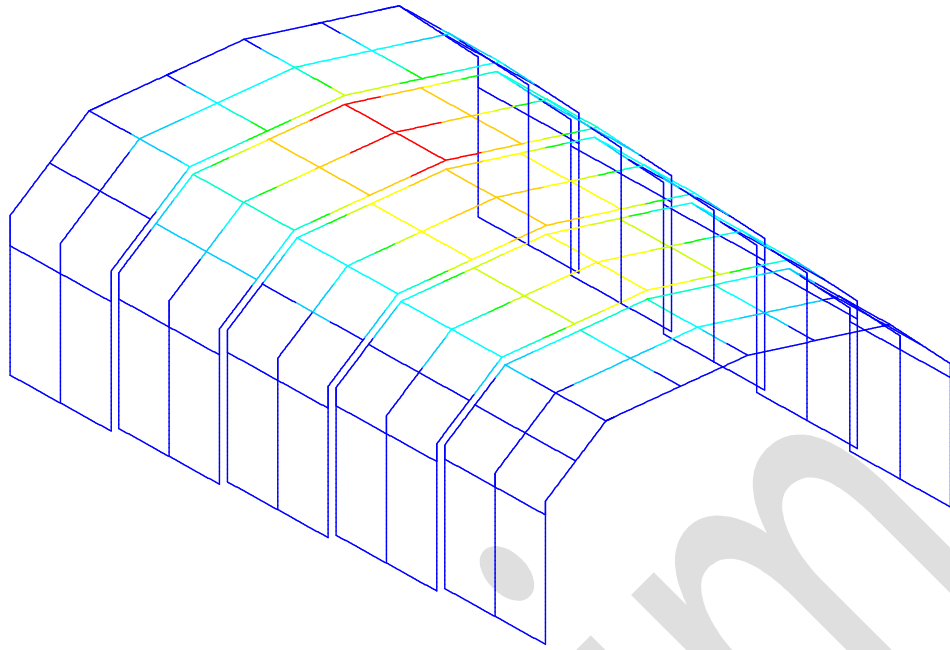
恒载工况 U_z :mm (整体)



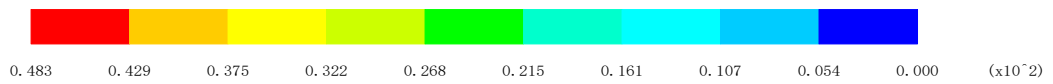
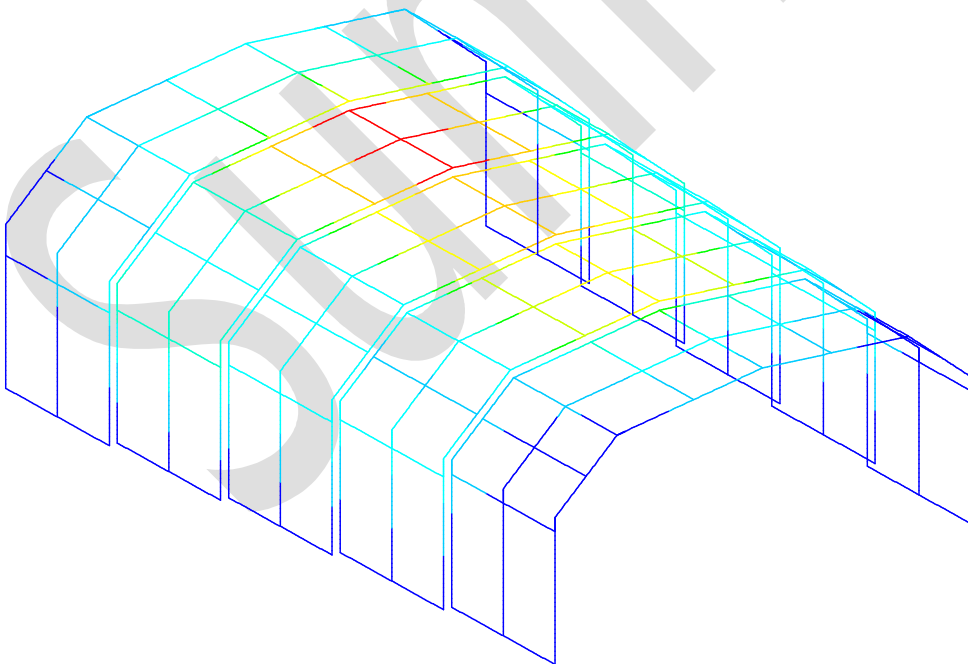
恒载工况 U_{xyz} :mm (整体)



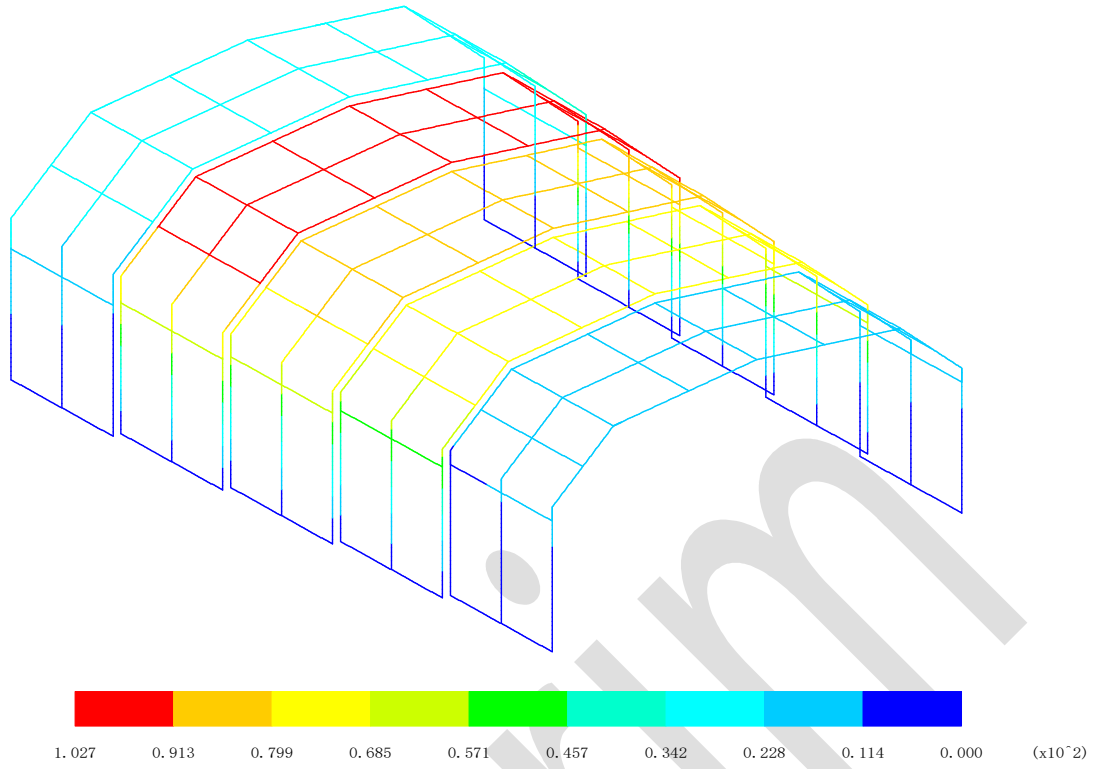
雪载工况1 U_x :mm (整体)



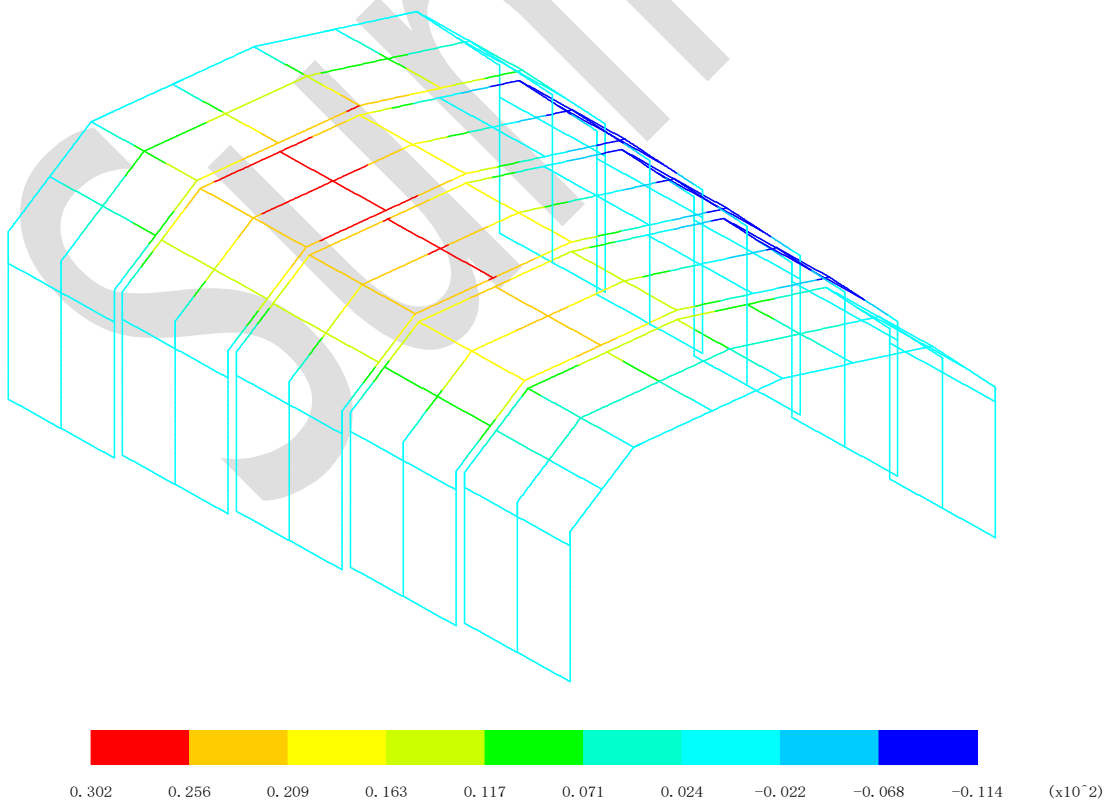
雪载工况1 Uz:mm (整体)



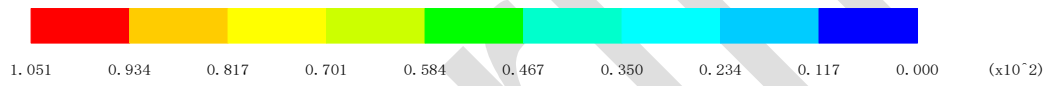
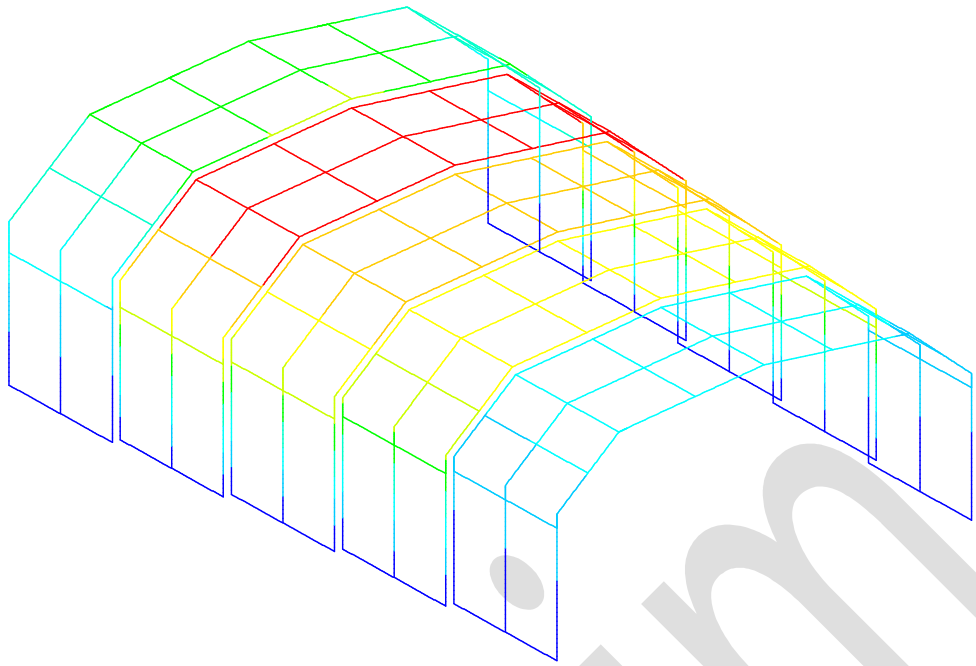
雪载工况1 Uxyz:mm (整体)



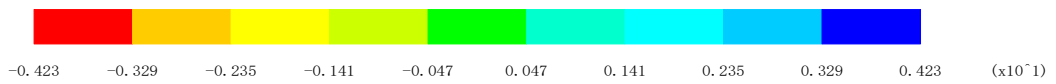
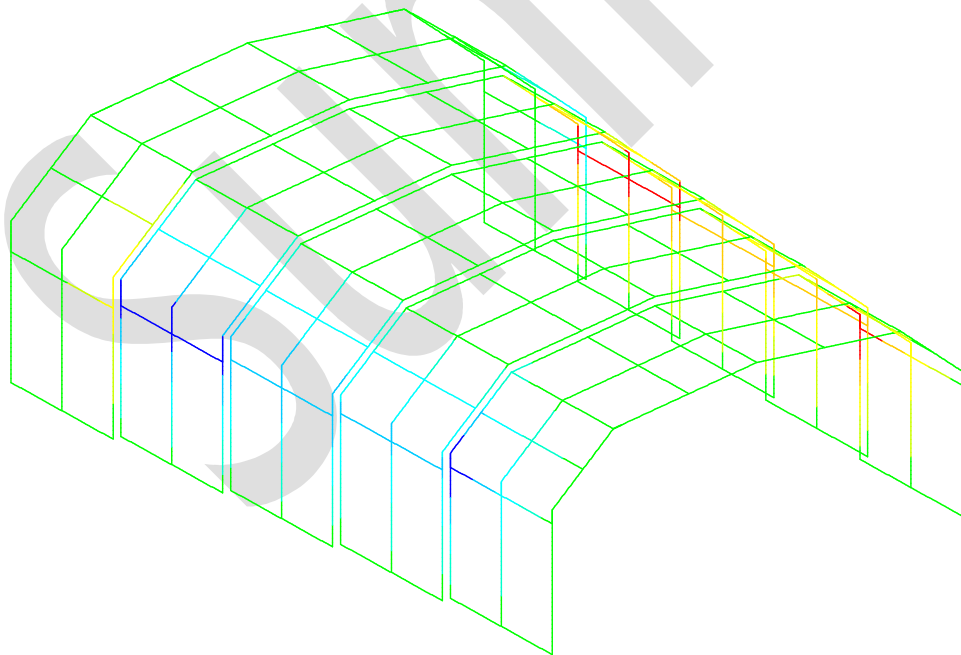
风载工况2_左 U_x:mm (整体)



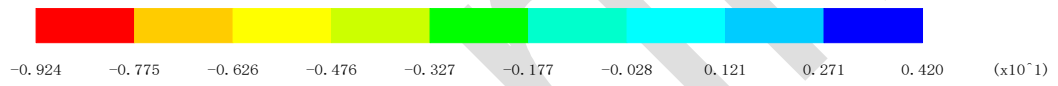
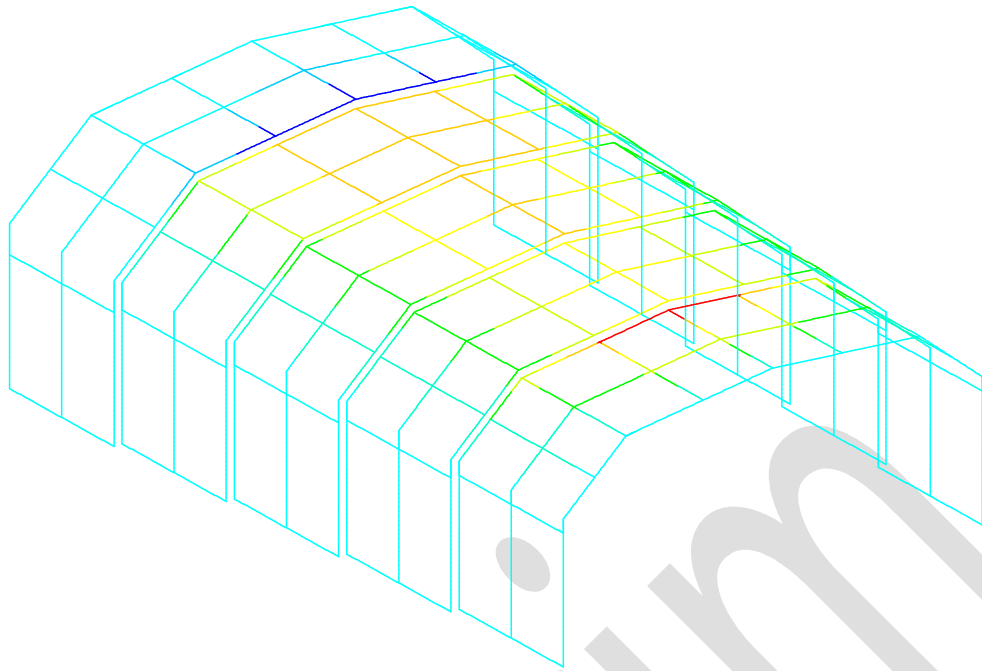
风载工况2_左 U_z:mm (整体)



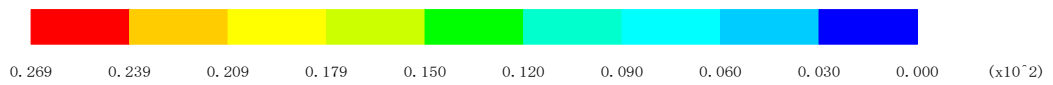
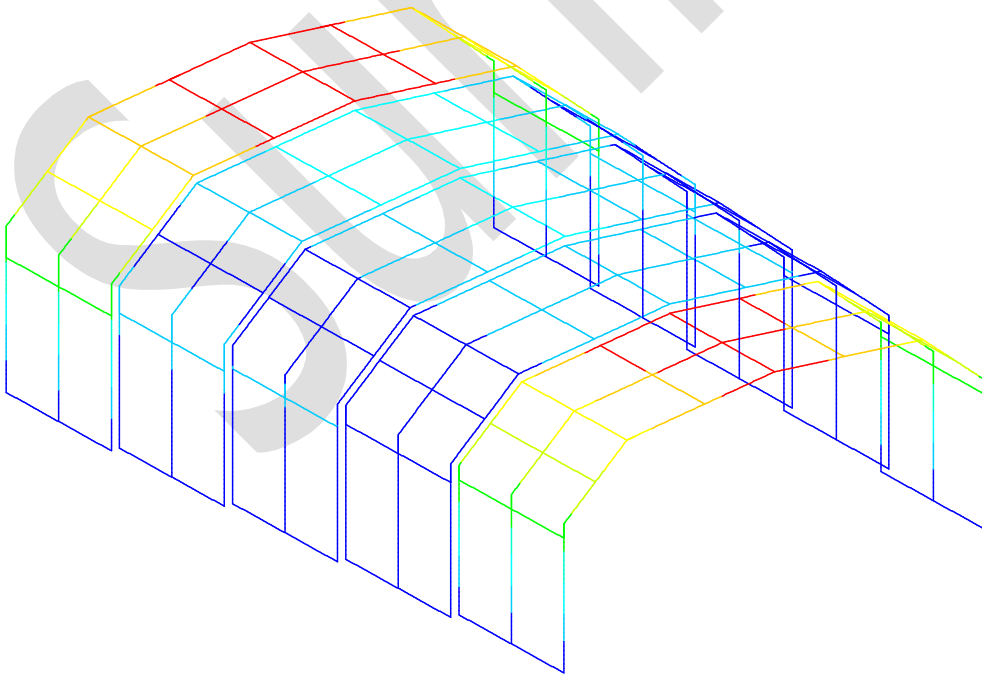
风载工况2_左 Uxyz:mm (整体)



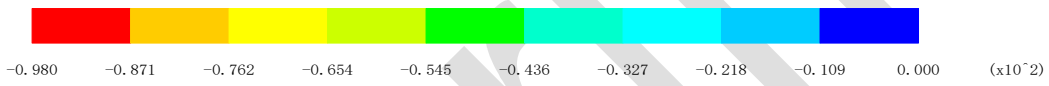
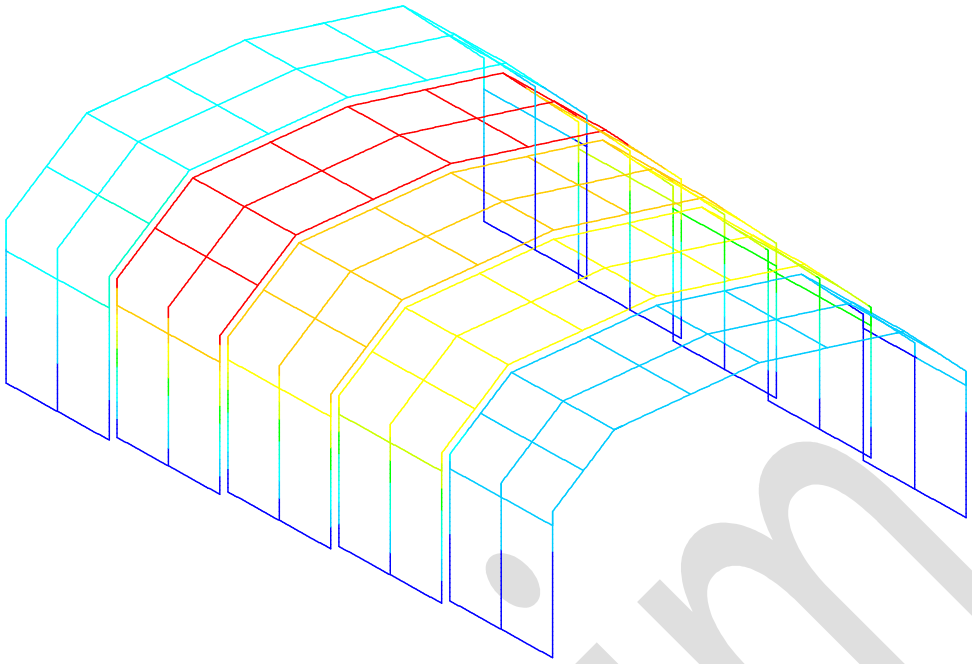
风载工况3_前 Ux:mm (整体)



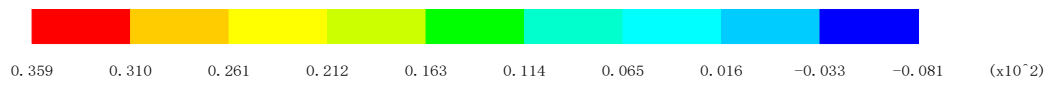
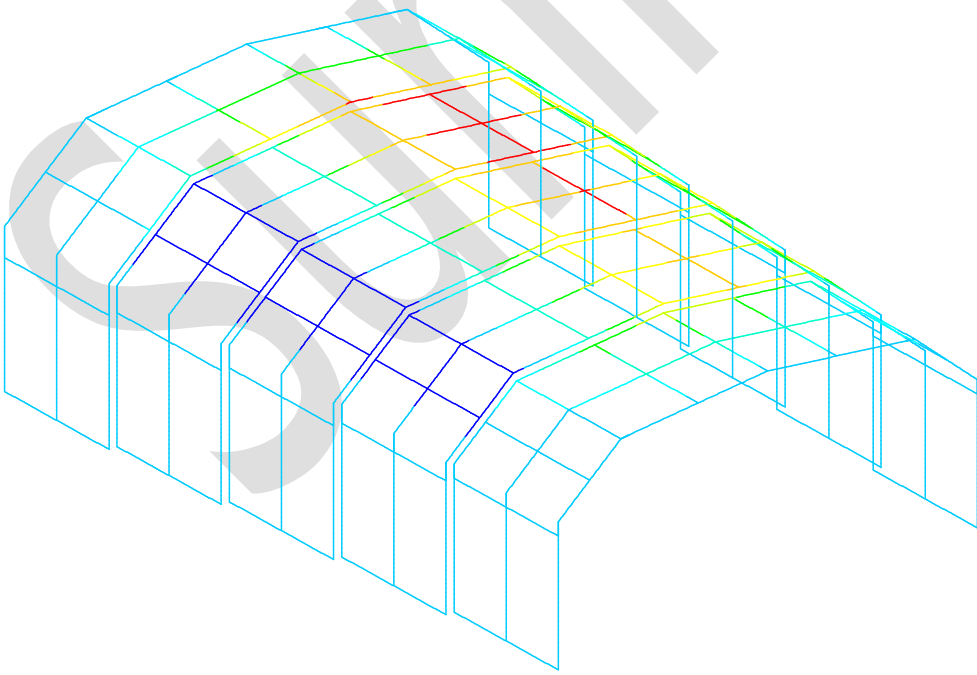
风载工况3_前 Uz:mm (整体)



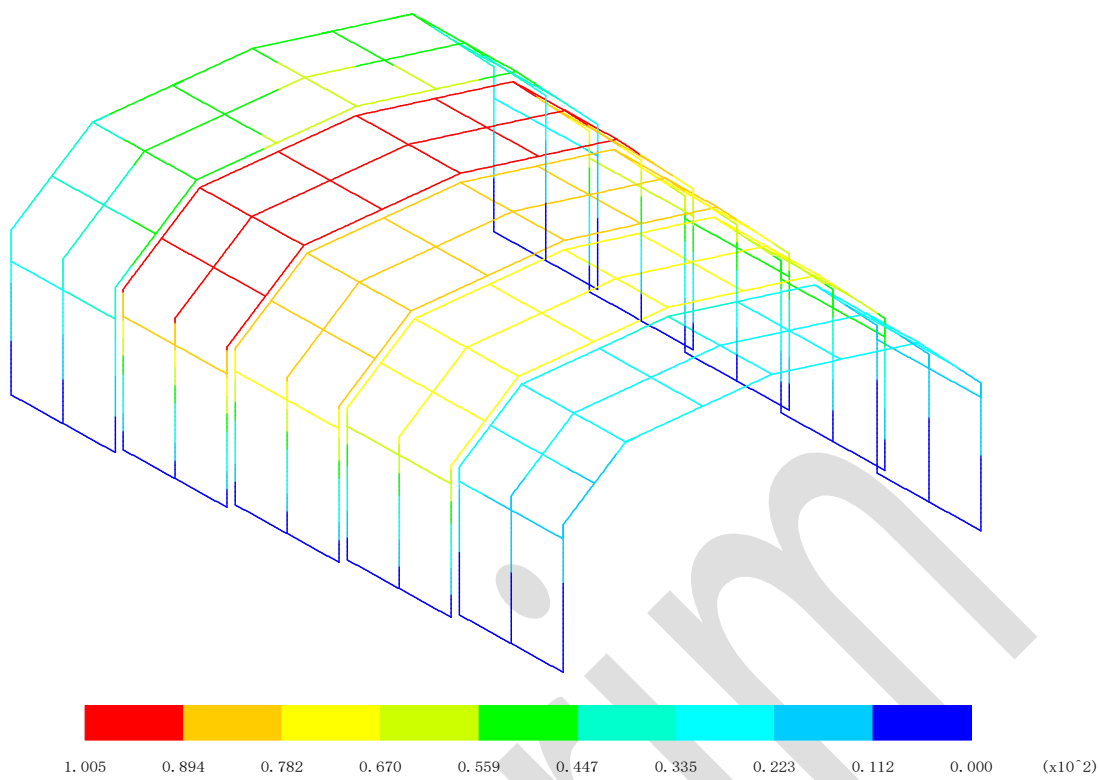
风载工况3_前 Uxyz:mm (整体)



风载工况4_右 Ux:mm (整体)

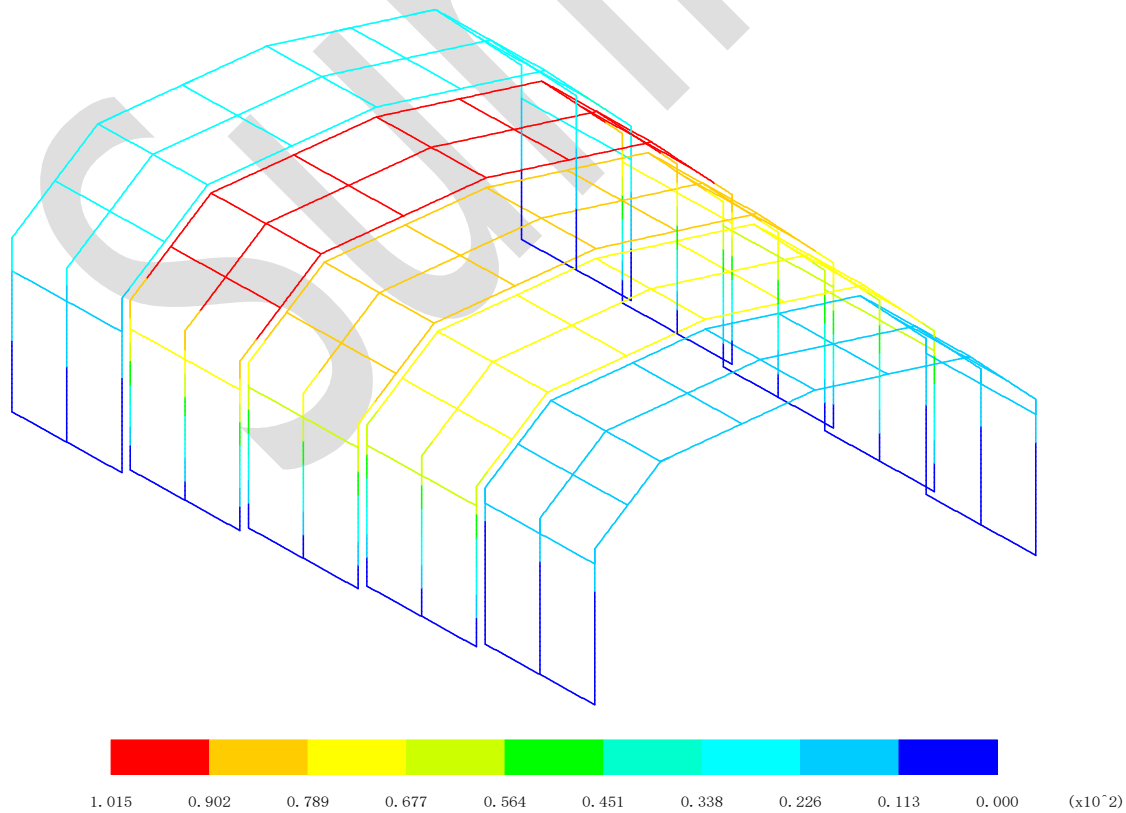


风载工况4_右 Uz:mm (整体)

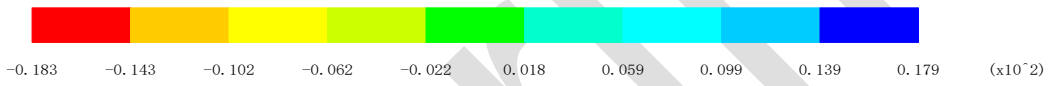
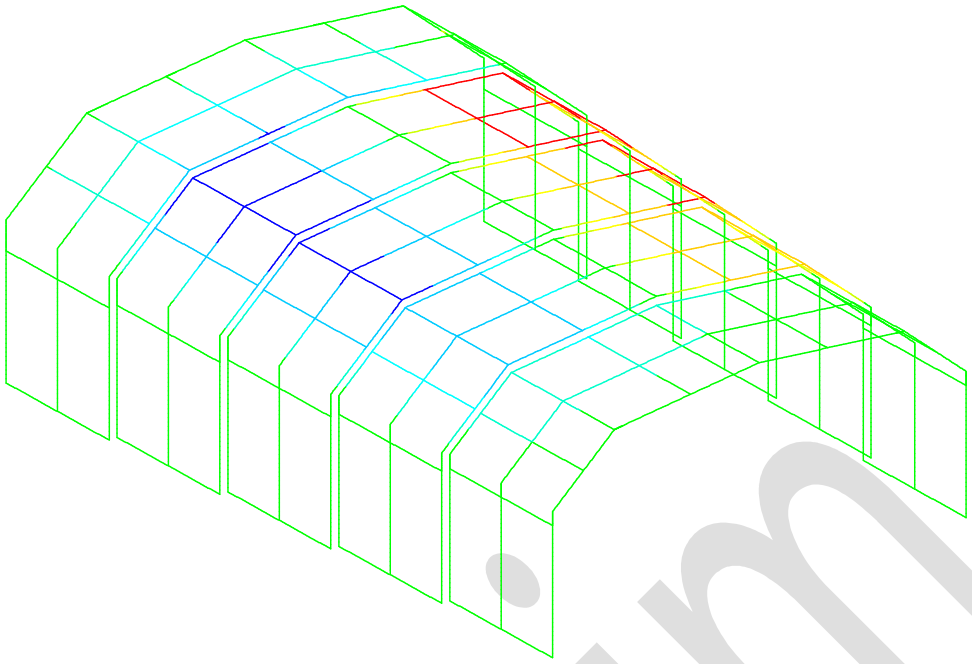


风载工况4_右 Uxyz:mm (整体)

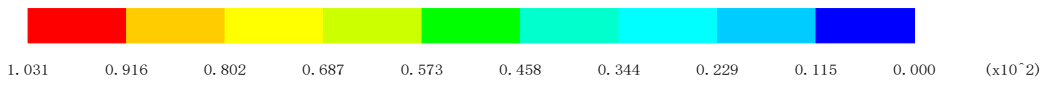
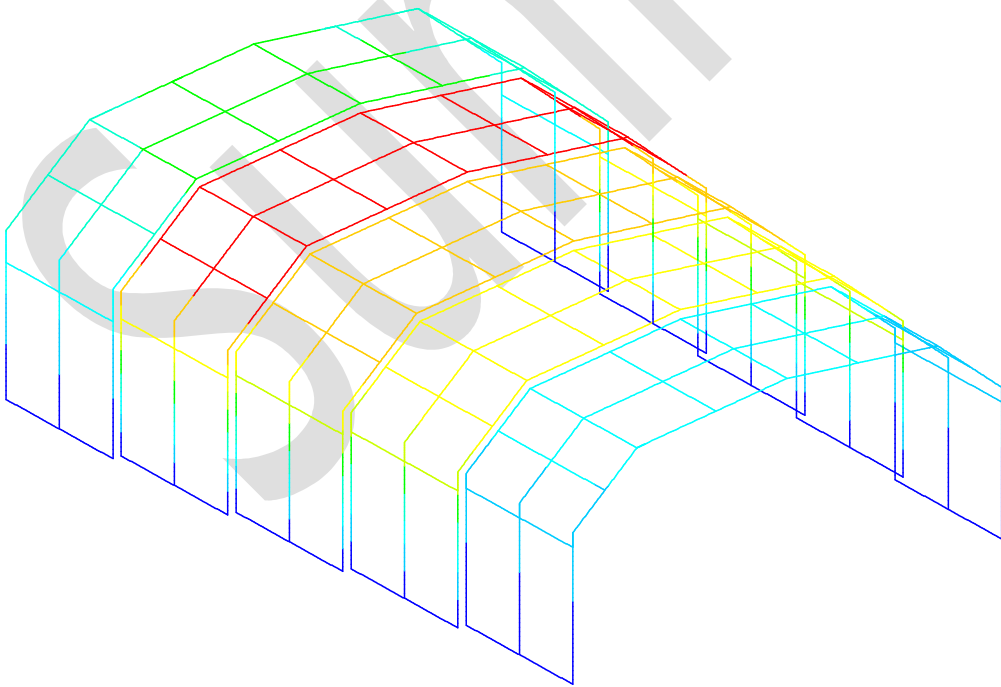
6.2.2 组合位移



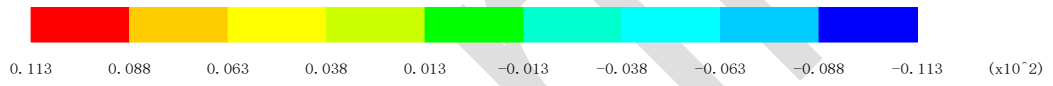
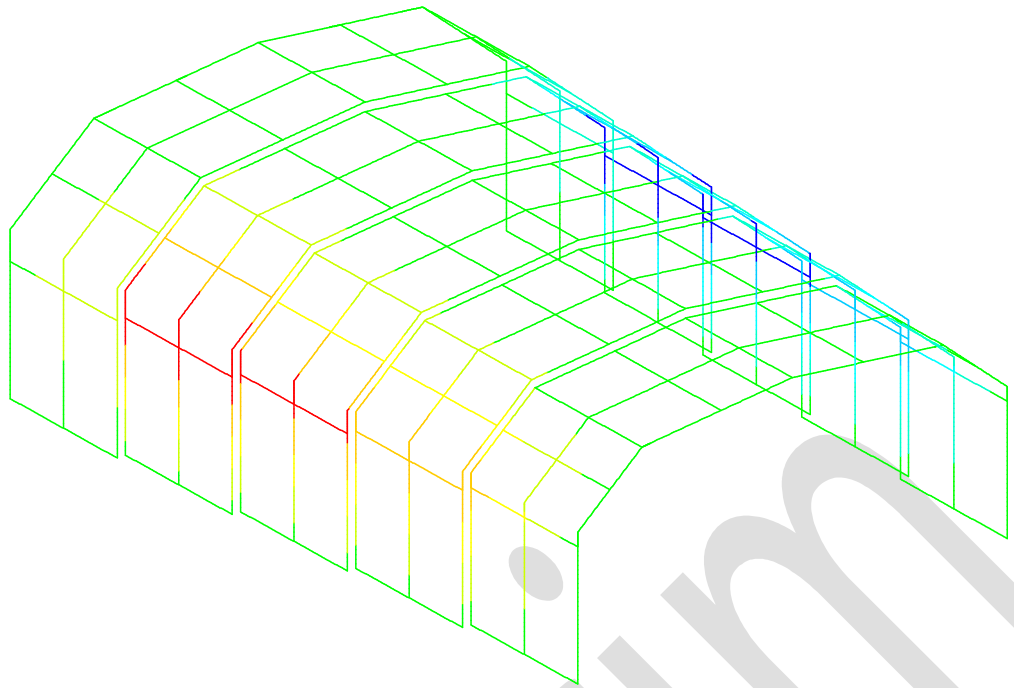
组合1 (恒0+风2) Ux:mm (整体)



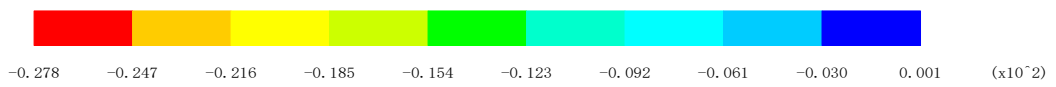
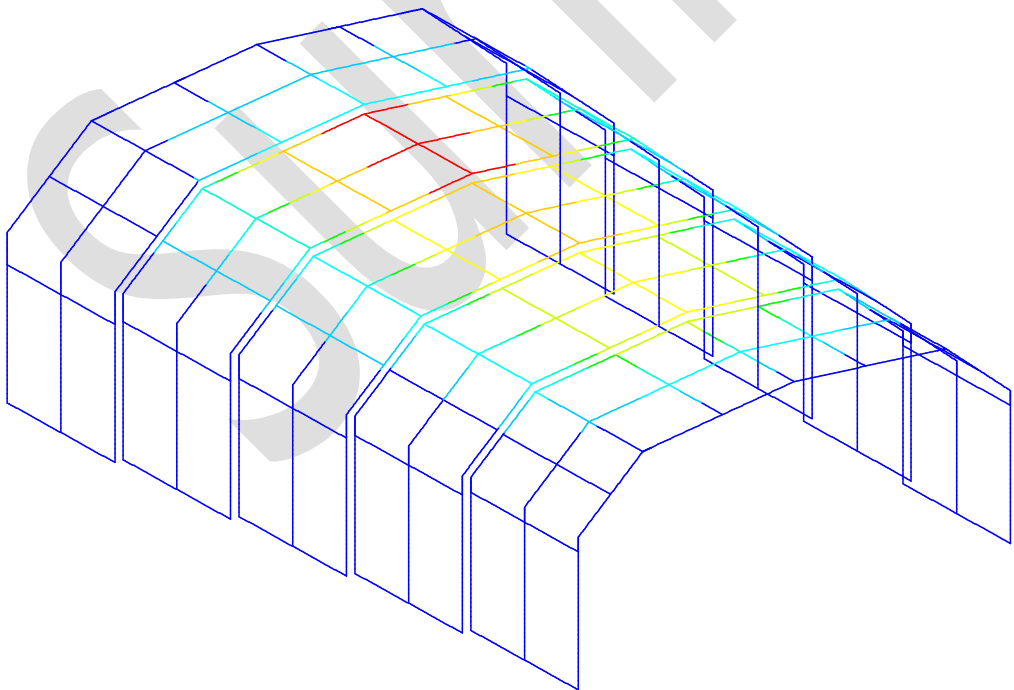
组合1 (恒0+风2) Uz:mm (整体)



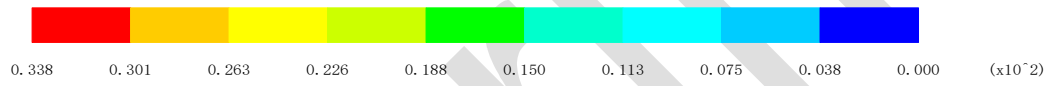
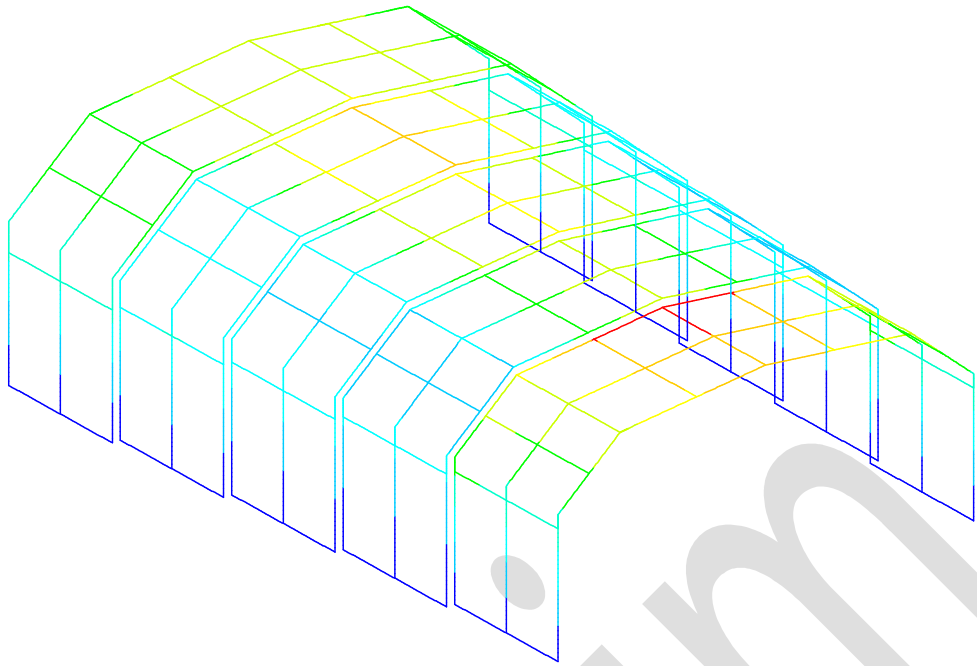
组合1 (恒0+风2) Uxyz:mm (整体)



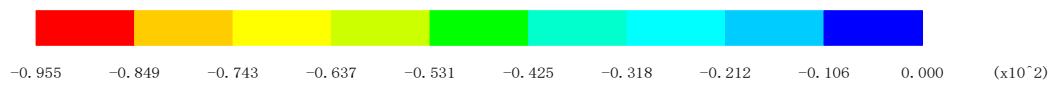
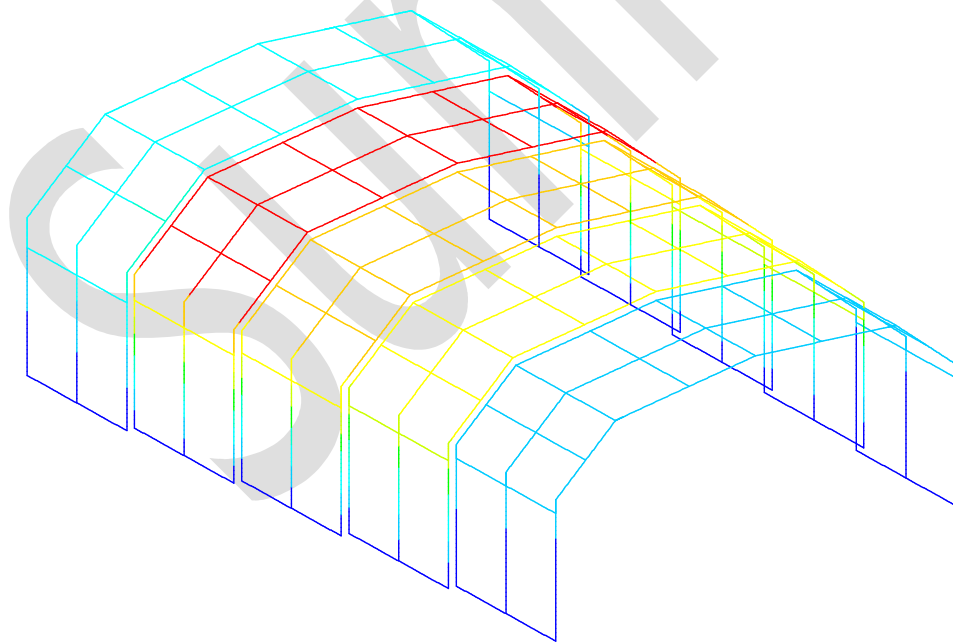
组合2 (恒0+风3) Ux:mm (整体)



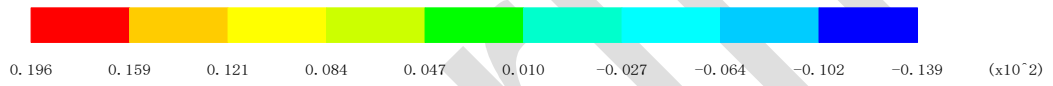
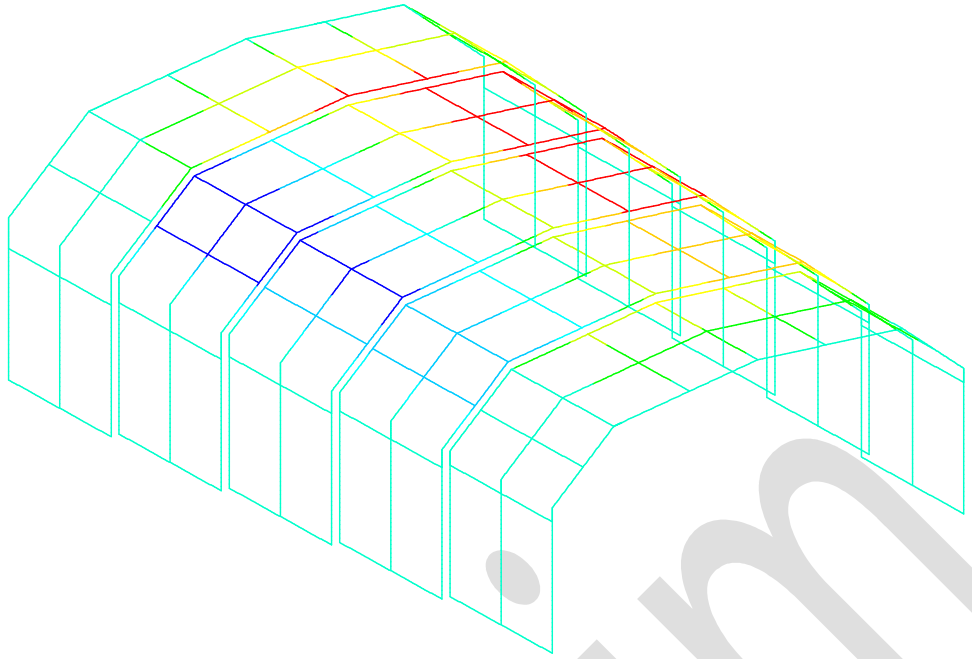
组合2 (恒0+风3) Uz:mm (整体)



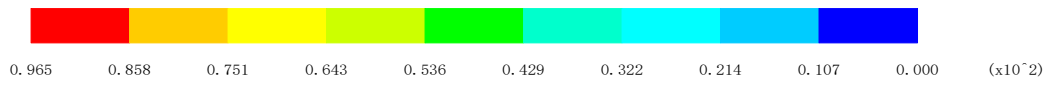
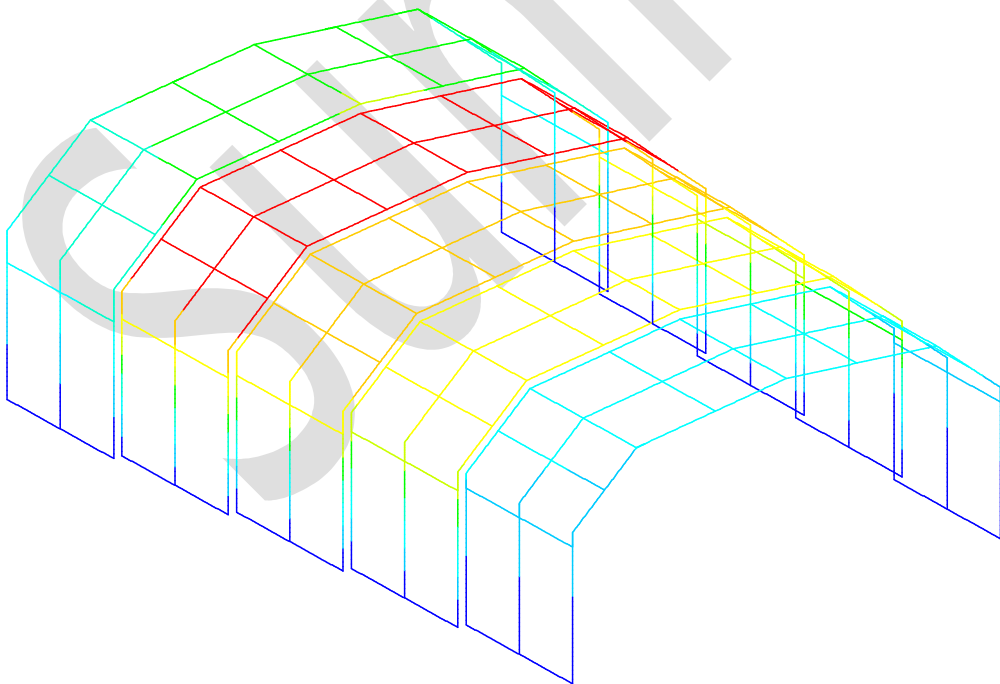
组合2 (恒0+风3) Uxyz:mm (整体)



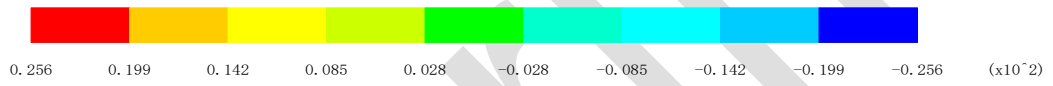
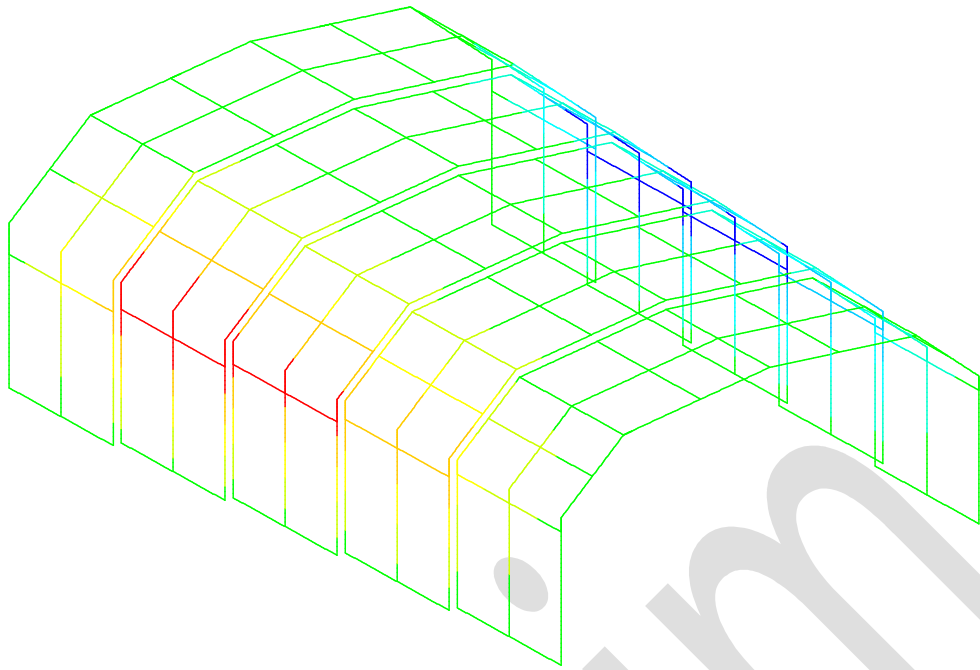
组合3 (恒0+风4) Ux:mm (整体)



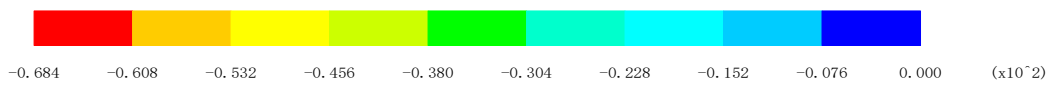
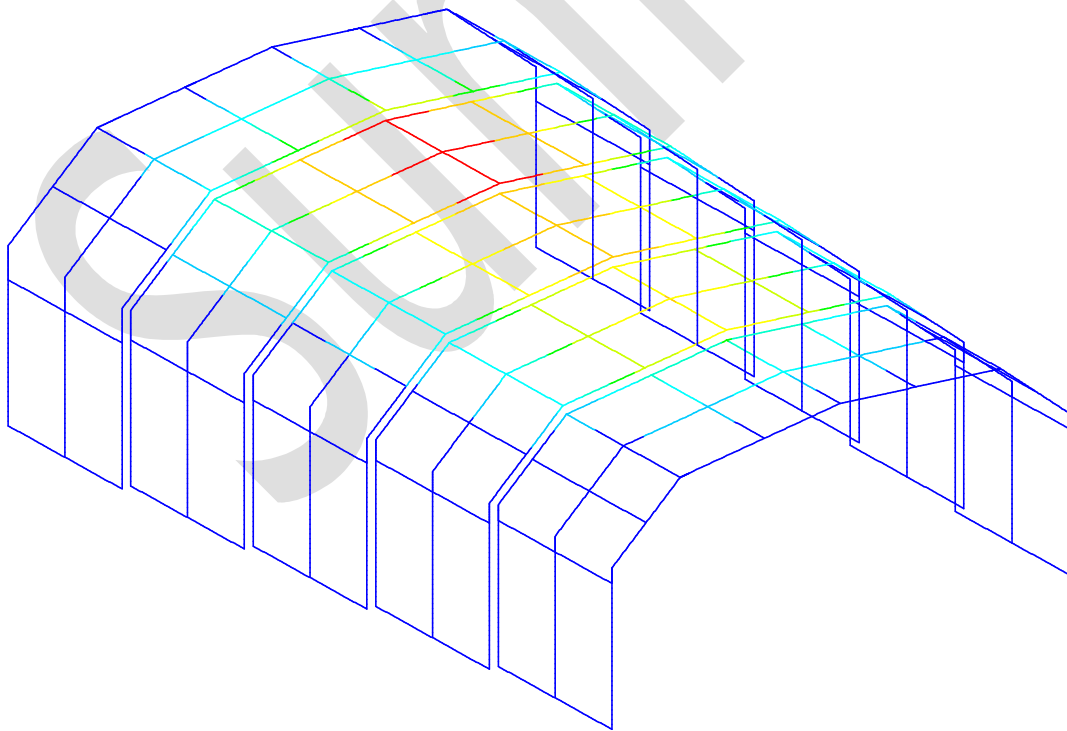
组合3 (恒0+风4) Uz:mm (整体)



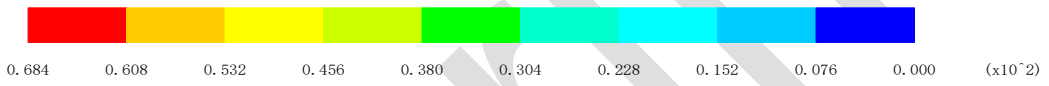
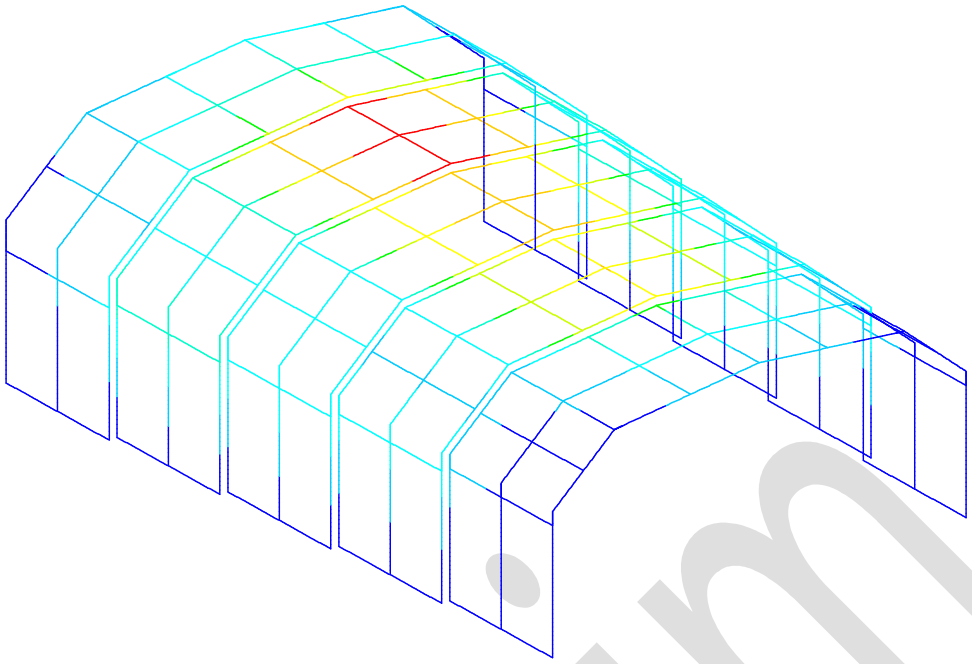
组合3 (恒0+风4) Uxyz:mm (整体)



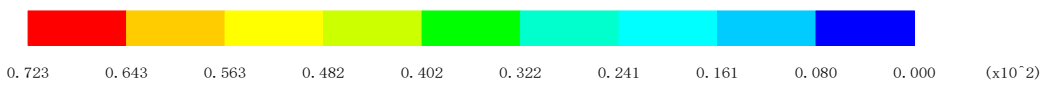
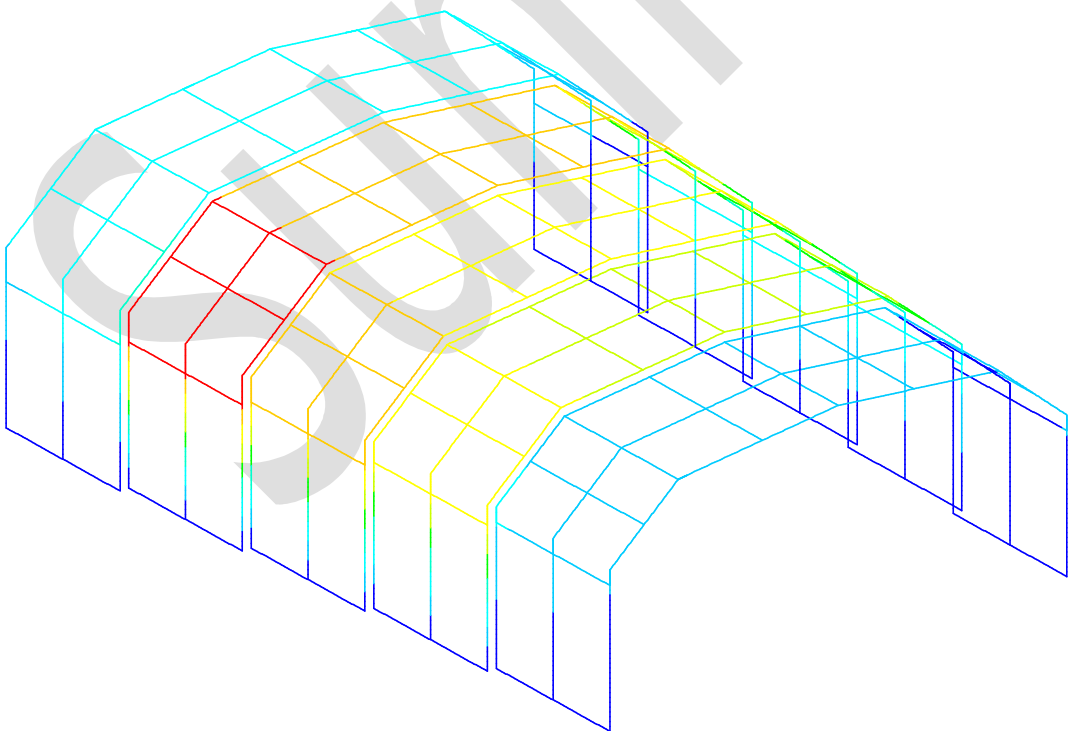
组合4 (恒0+雪1) U_x:mm (整体)



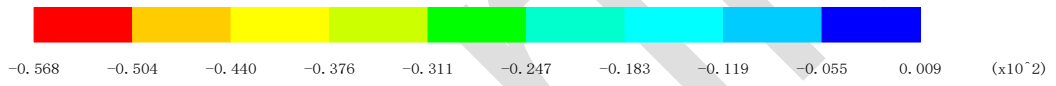
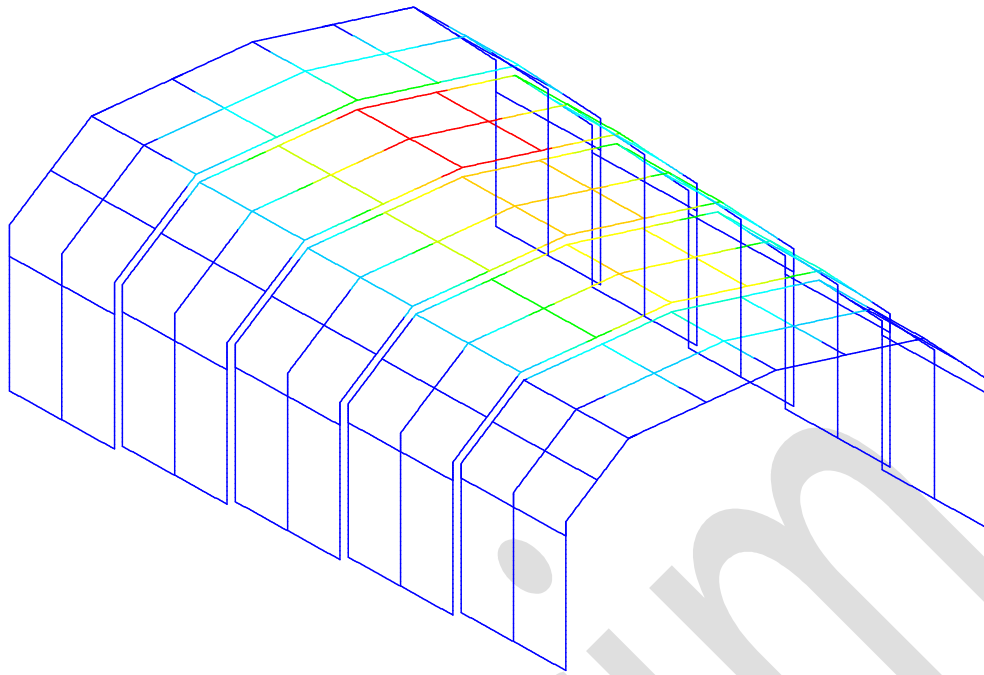
组合4 (恒0+雪1) U_z:mm (整体)



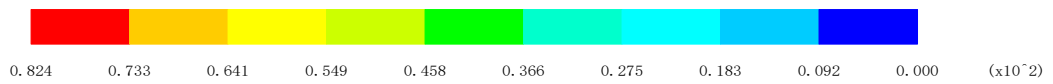
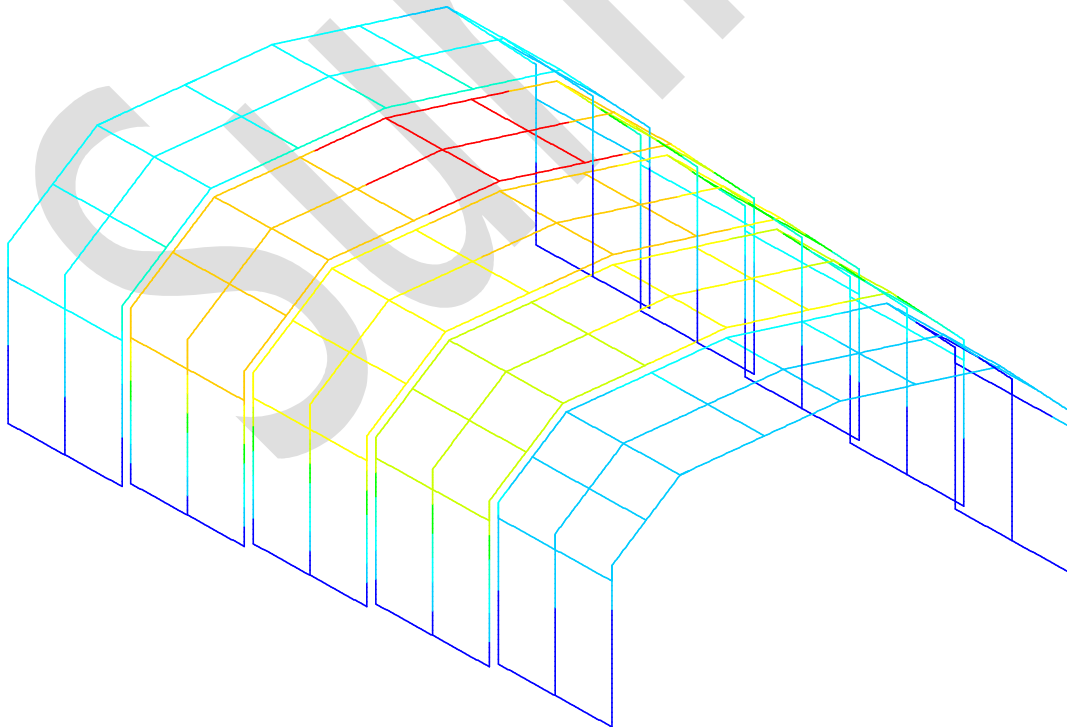
组合4 (恒0+雪1) Uxyz:mm (整体)



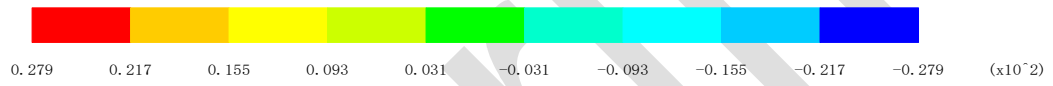
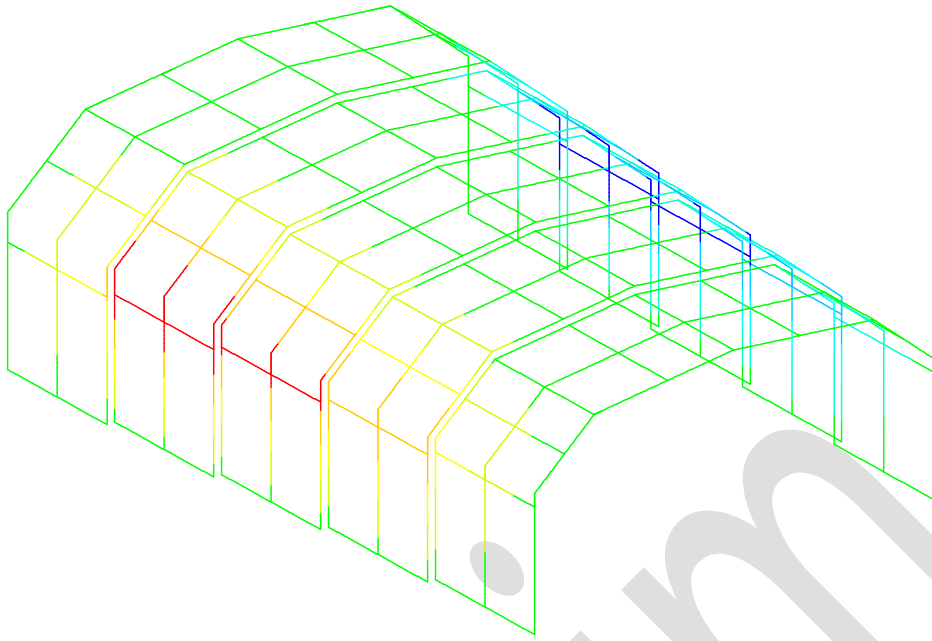
组合5 (恒0+雪1+0.6风2) Ux:mm (整体)



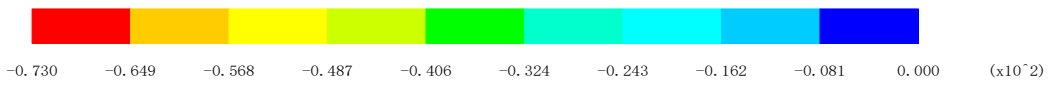
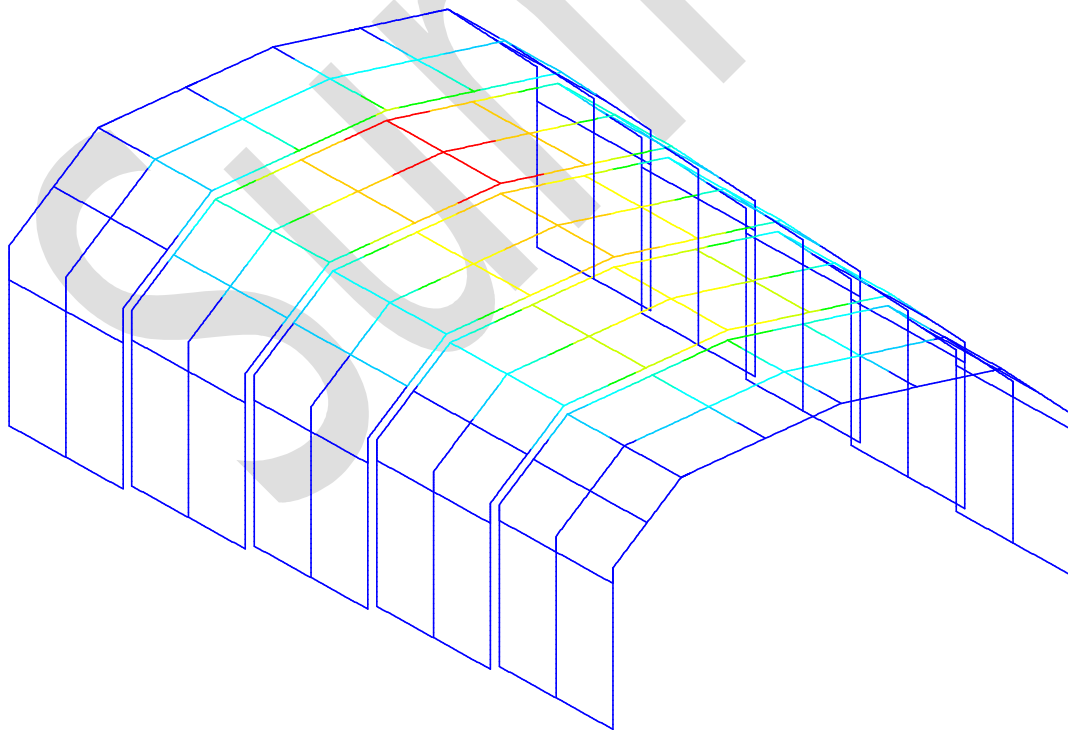
组合5 (恒0+雪1+0.6风2) Uz:mm (整体)



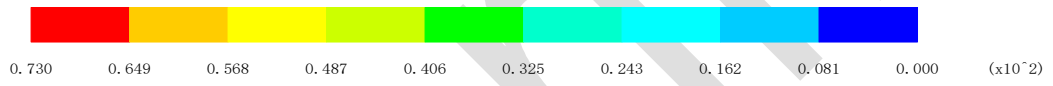
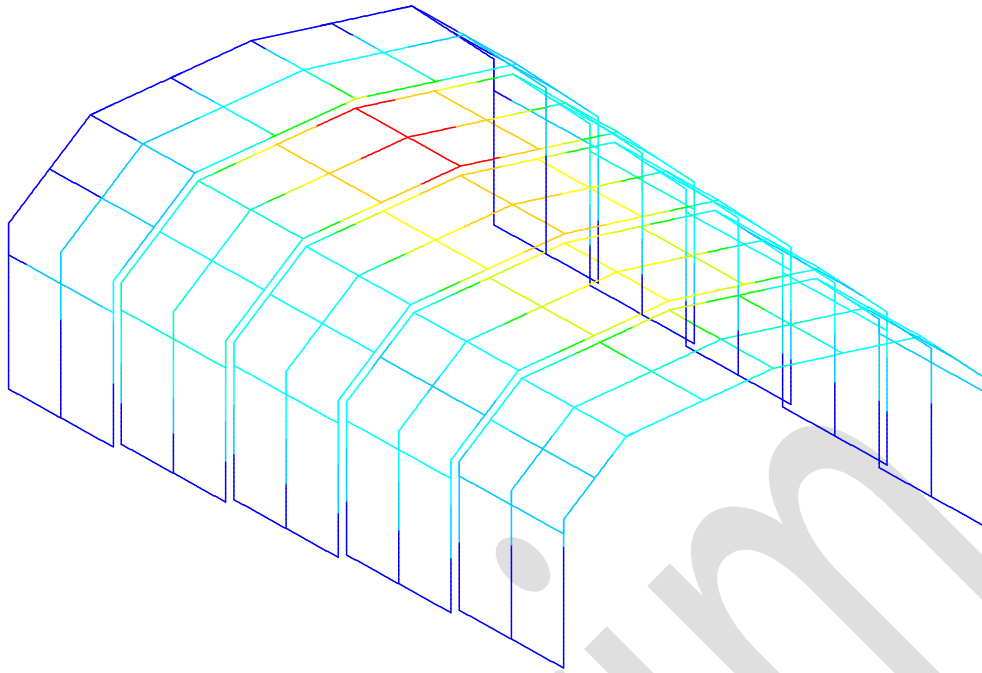
组合5 (恒0+雪1+0.6风2) Uxyz:mm (整体)



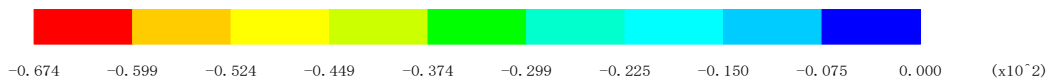
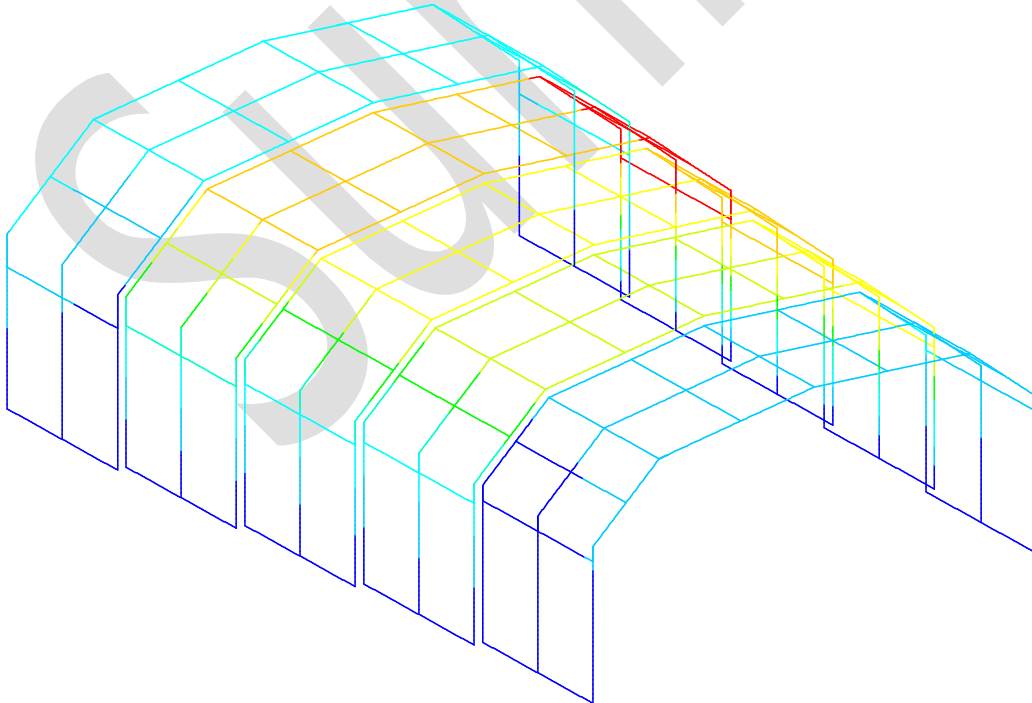
组合6 (恒0+雪1+0.6风3) Ux:mm (整体)



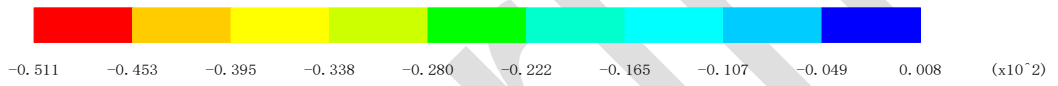
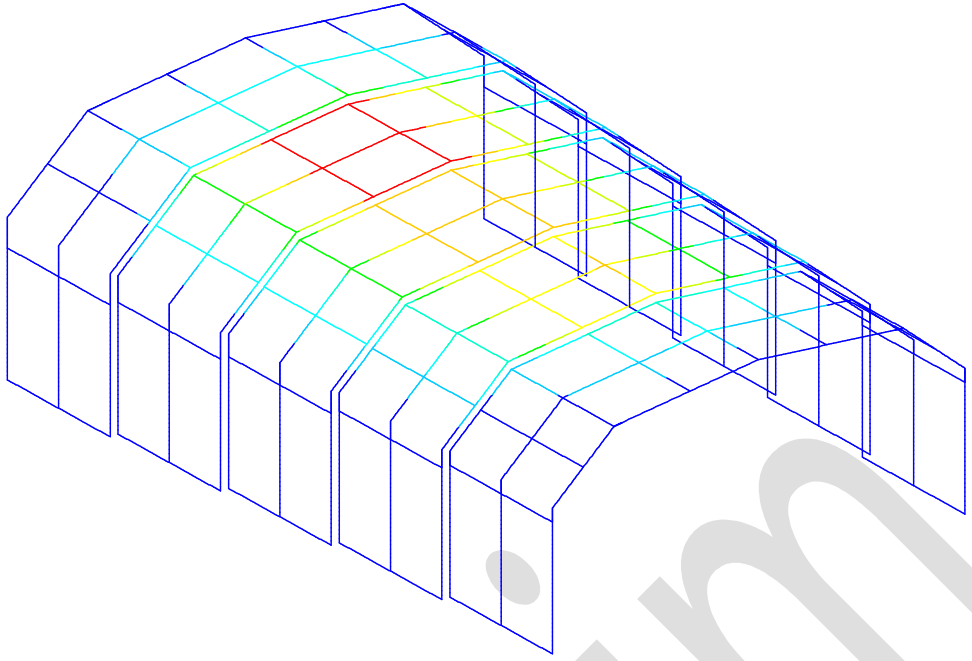
组合6 (恒0+雪1+0.6风3) Uz:mm (整体)



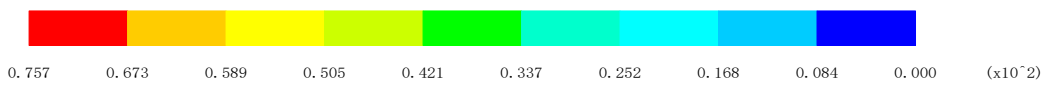
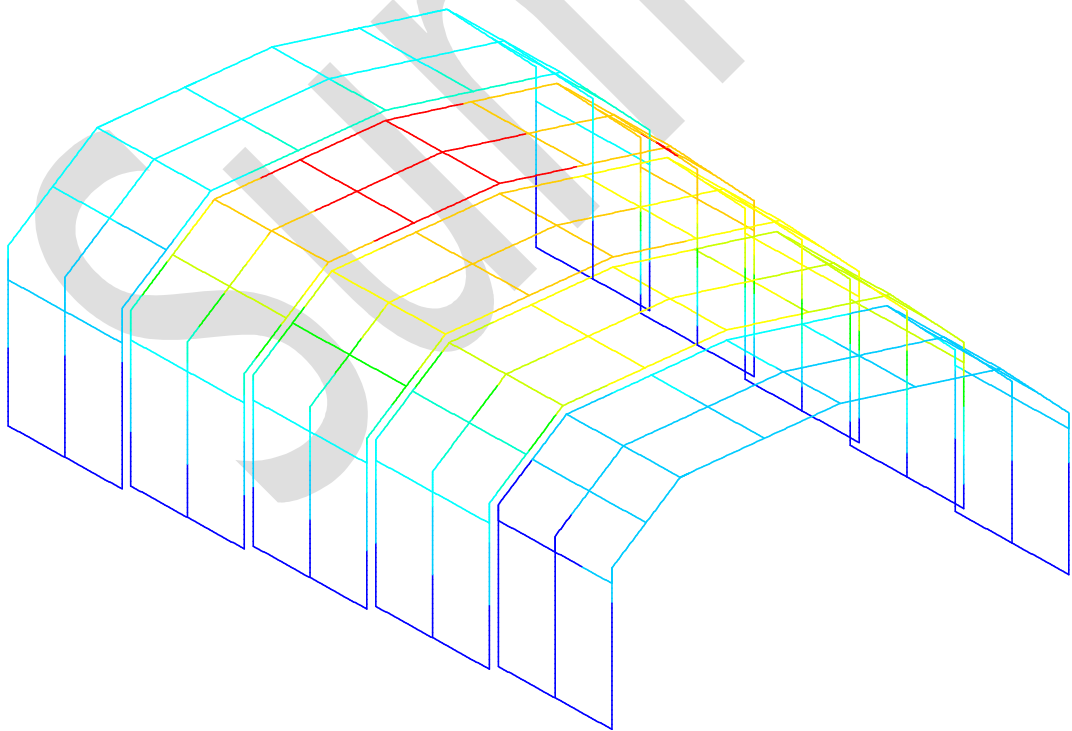
组合6 (恒0+雪1+0.6风3) Uxyz:mm (整体)



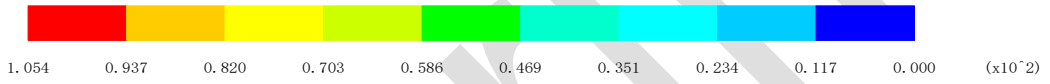
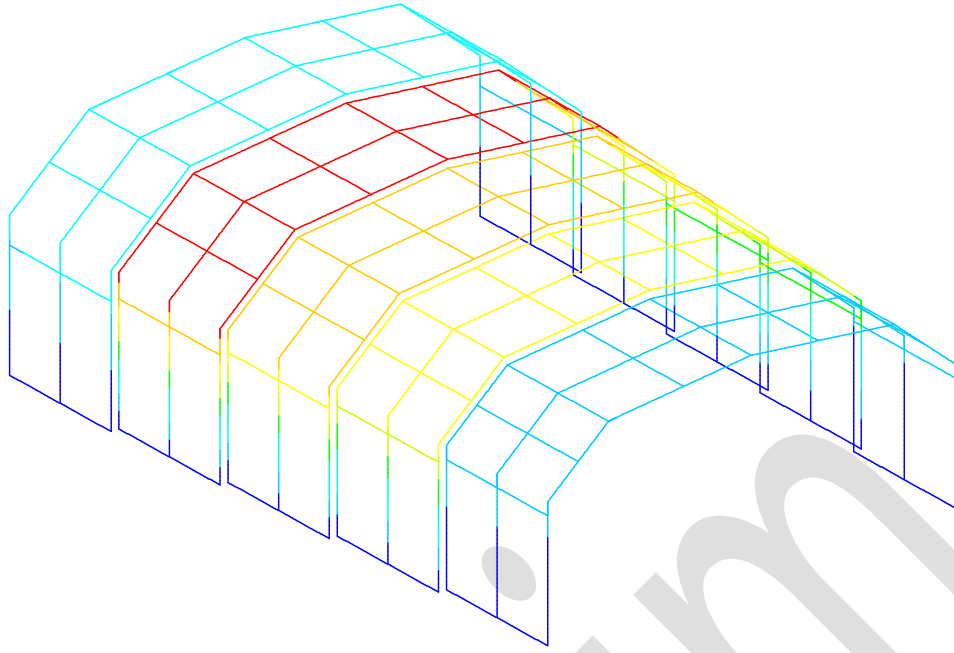
组合7 (恒0+雪1+0.6风4) Ux:mm (整体)



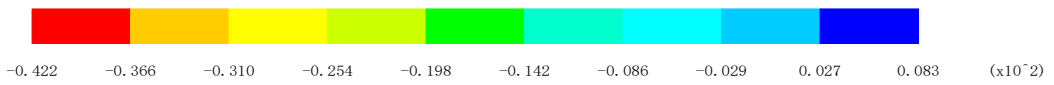
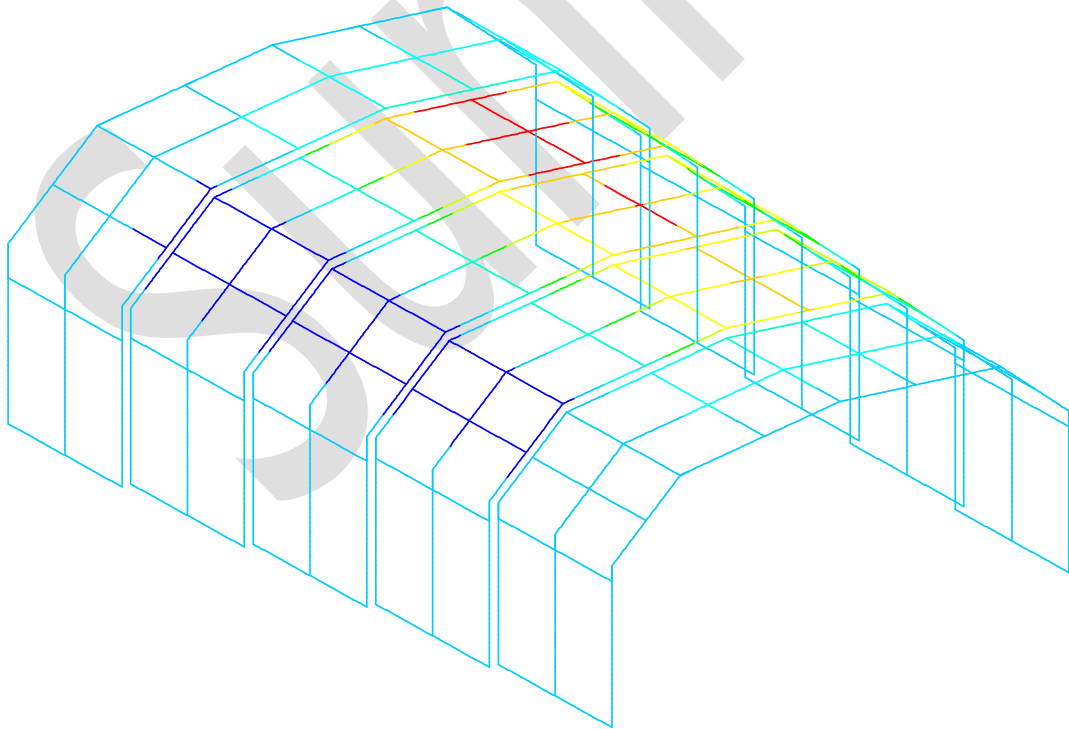
组合7 (恒0+雪1+0.6风4) Uz:mm (整体)



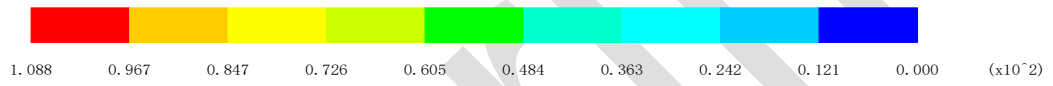
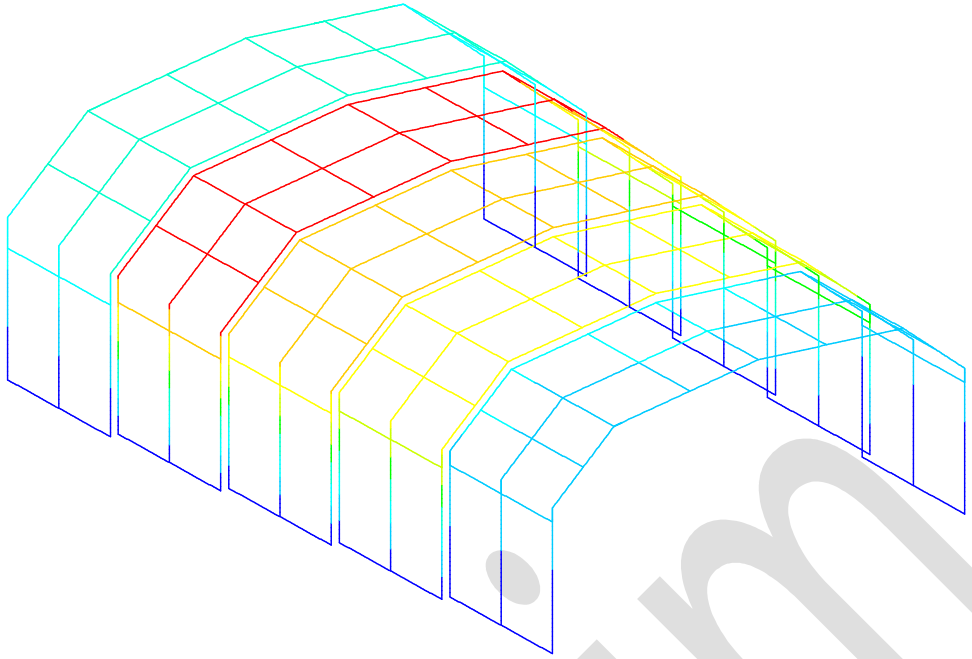
组合7 (恒0+雪1+0.6风4) Uxyz:mm (整体)



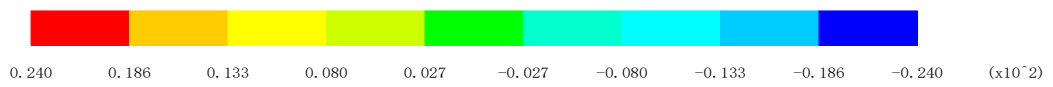
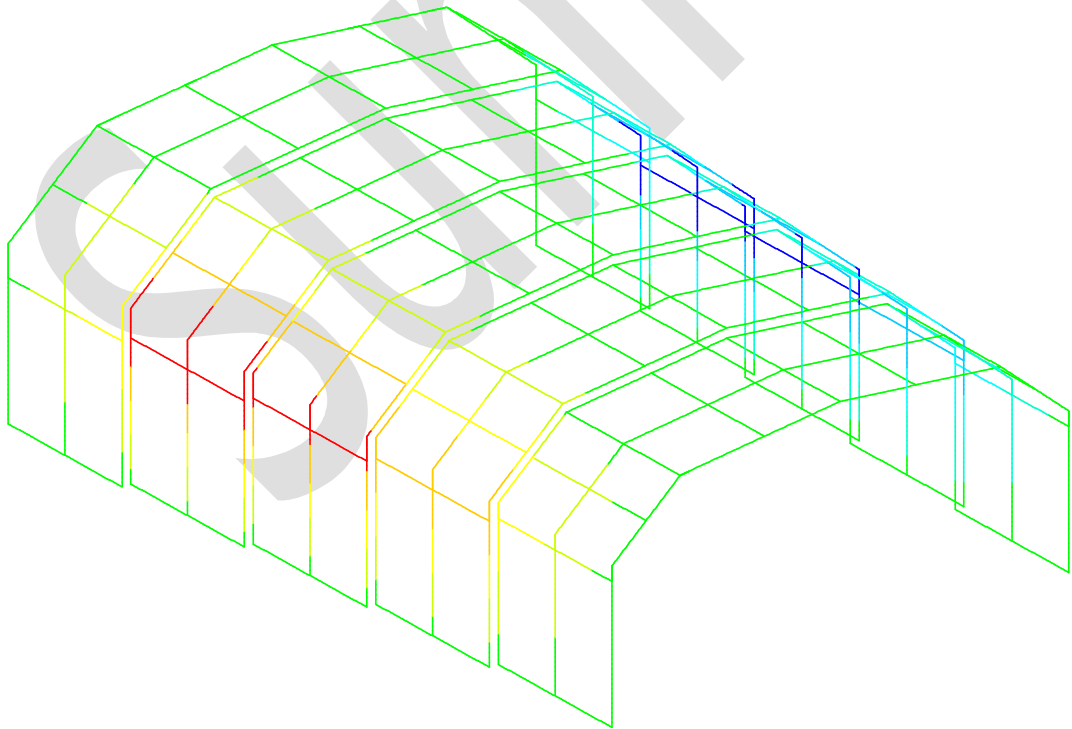
组合8 (恒0+0.7雪1+风2) Ux:mm (整体)



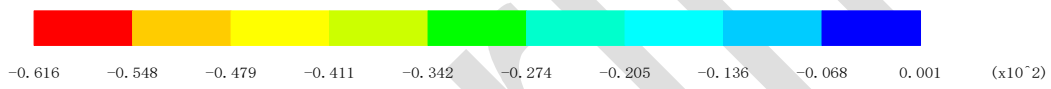
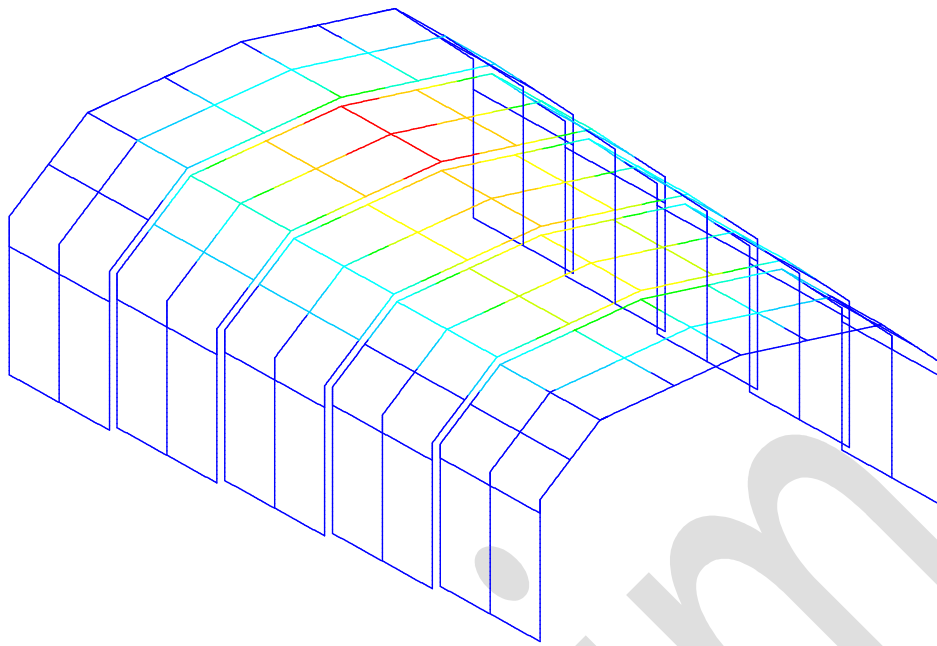
组合8 (恒0+0.7雪1+风2) Uz:mm (整体)



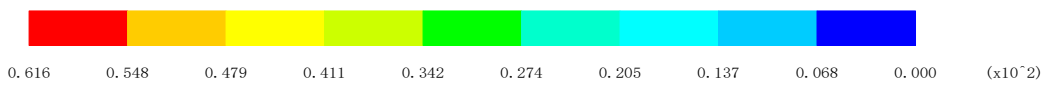
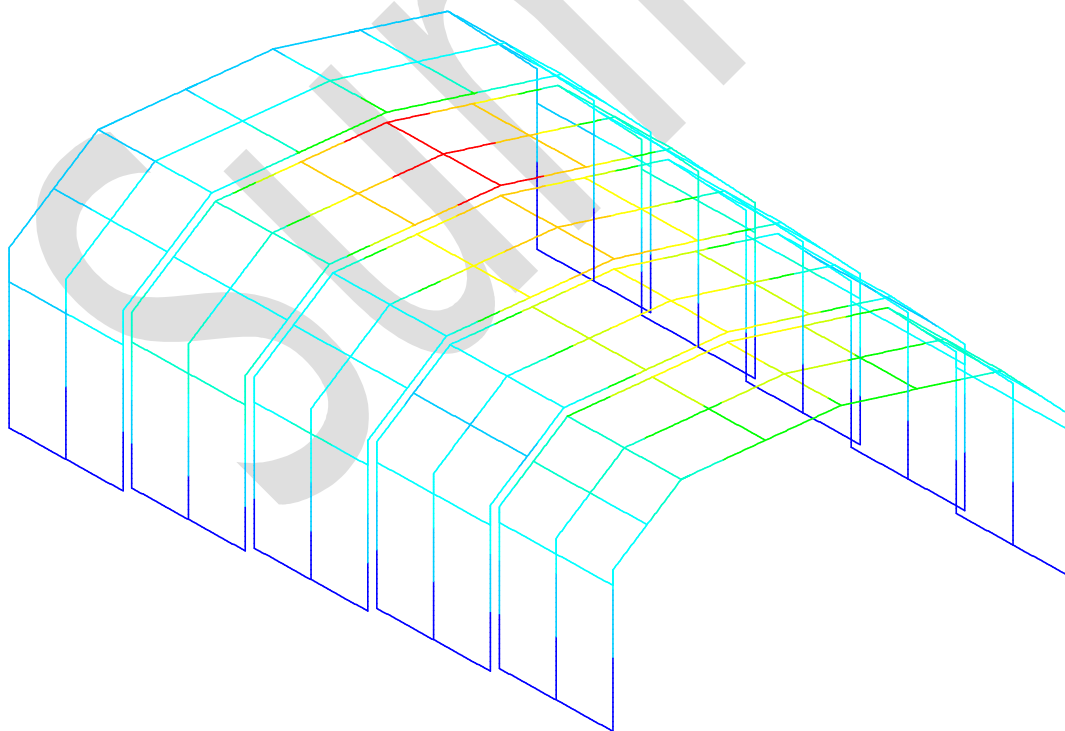
组合8 (恒0+0.7雪1+风2) U_{xyz}:mm (整体)



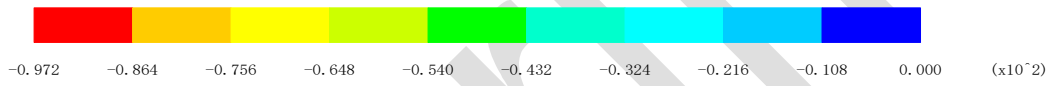
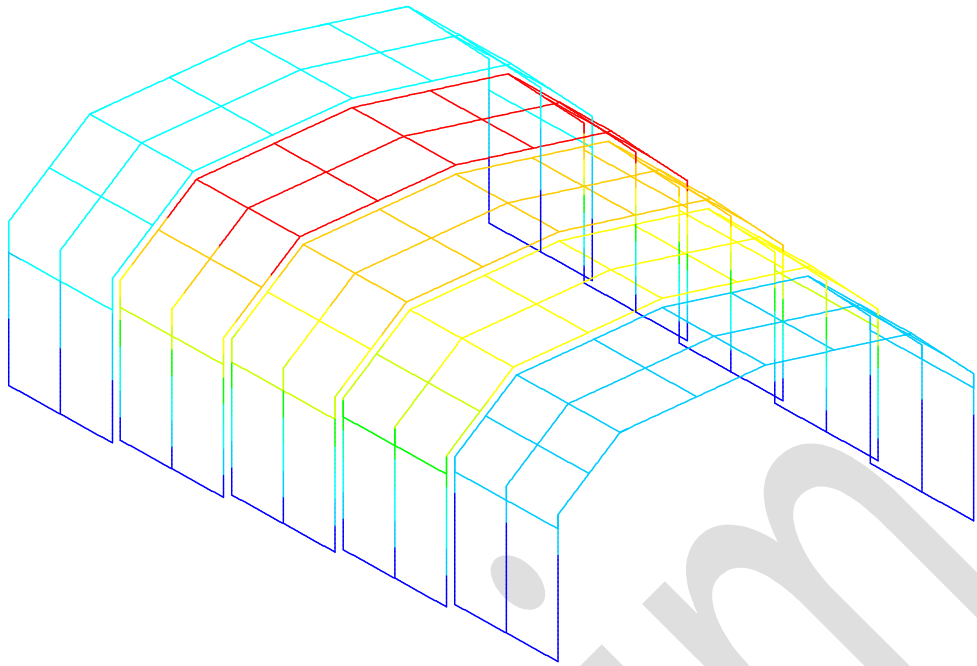
组合9 (恒0+0.7雪1+风3) U_x:mm (整体)



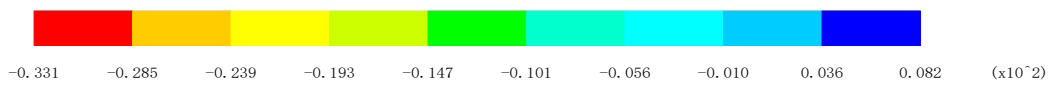
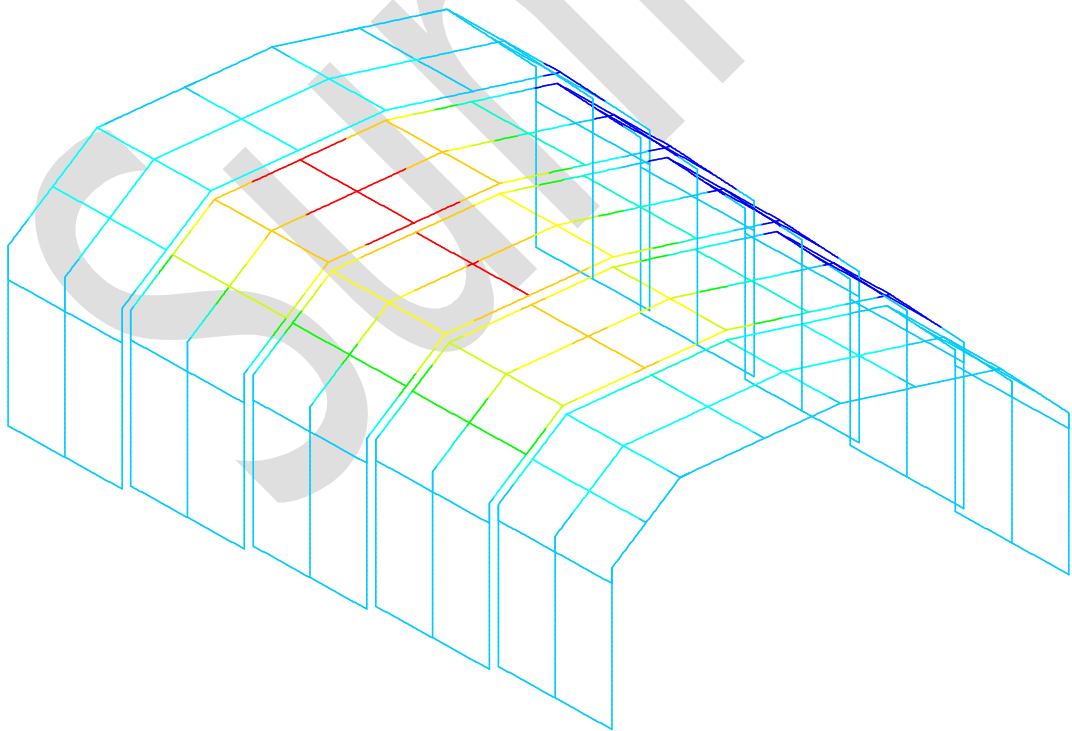
组合9 (恒0+0.7雪1+风3) Uz:mm (整体)



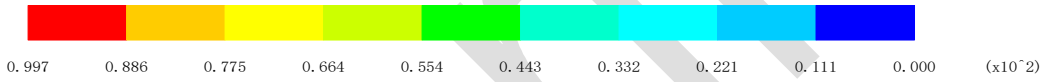
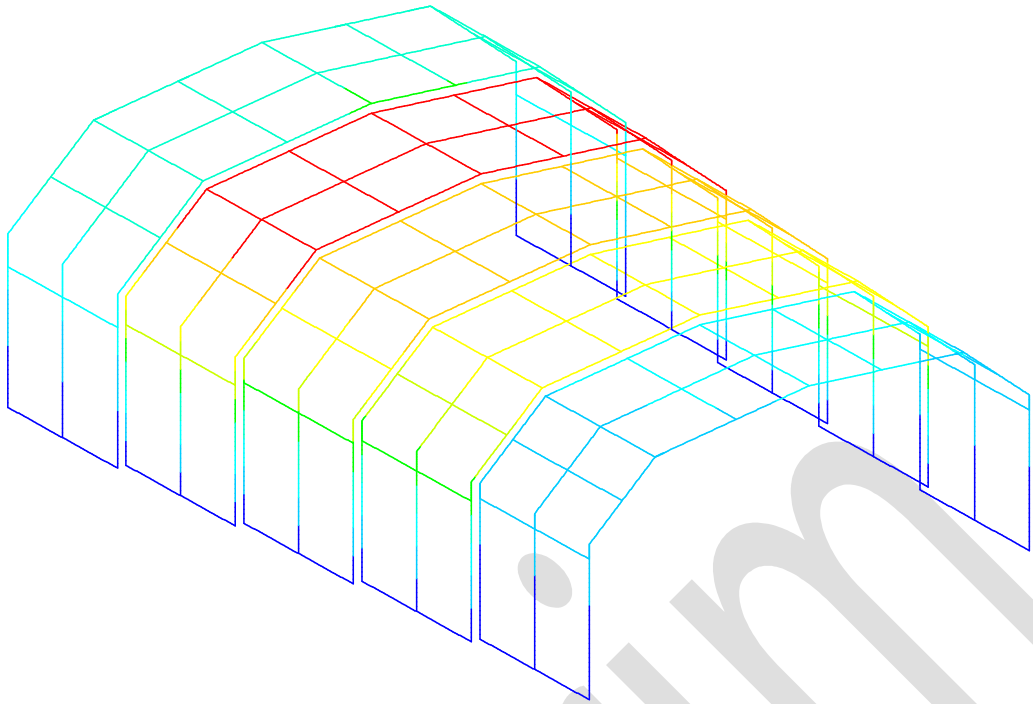
组合9 (恒0+0.7雪1+风3) Uxyz:mm (整体)



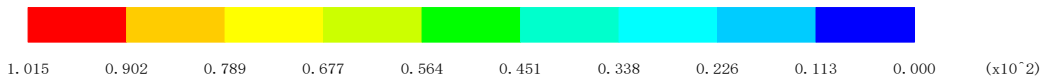
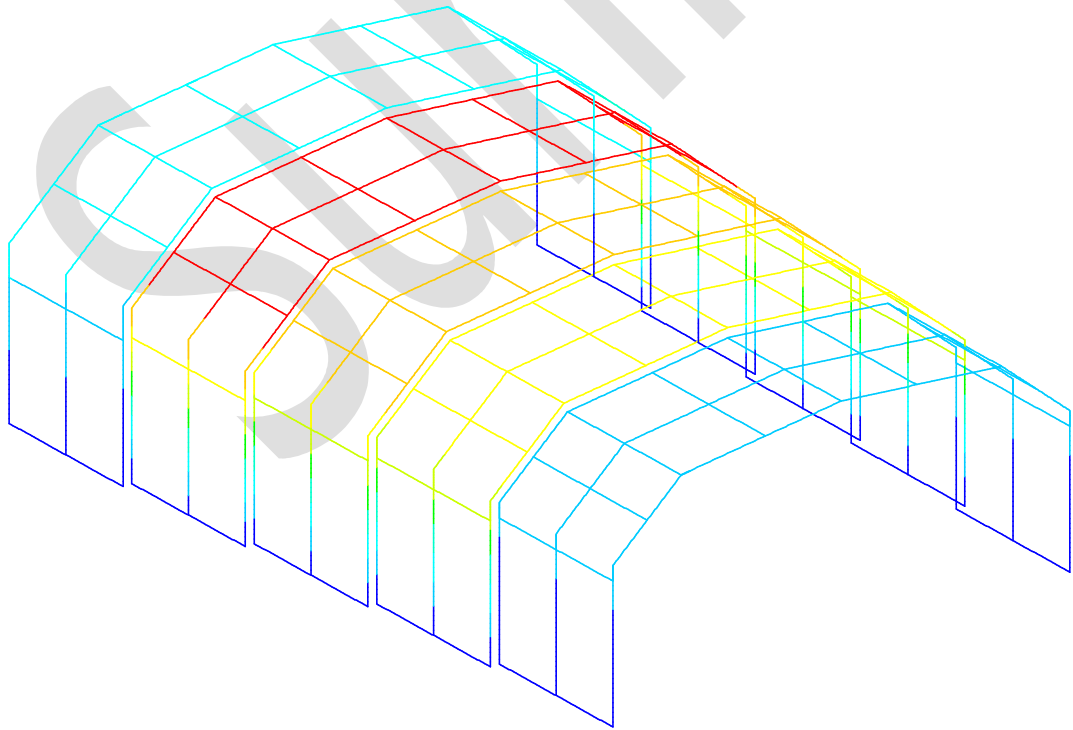
组合10 (恒0+0.7雪1+风4) Ux:mm (整体)



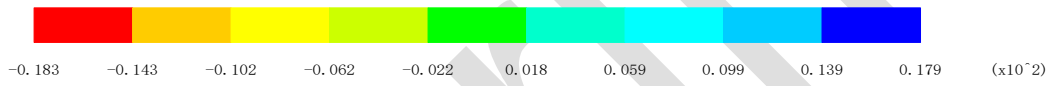
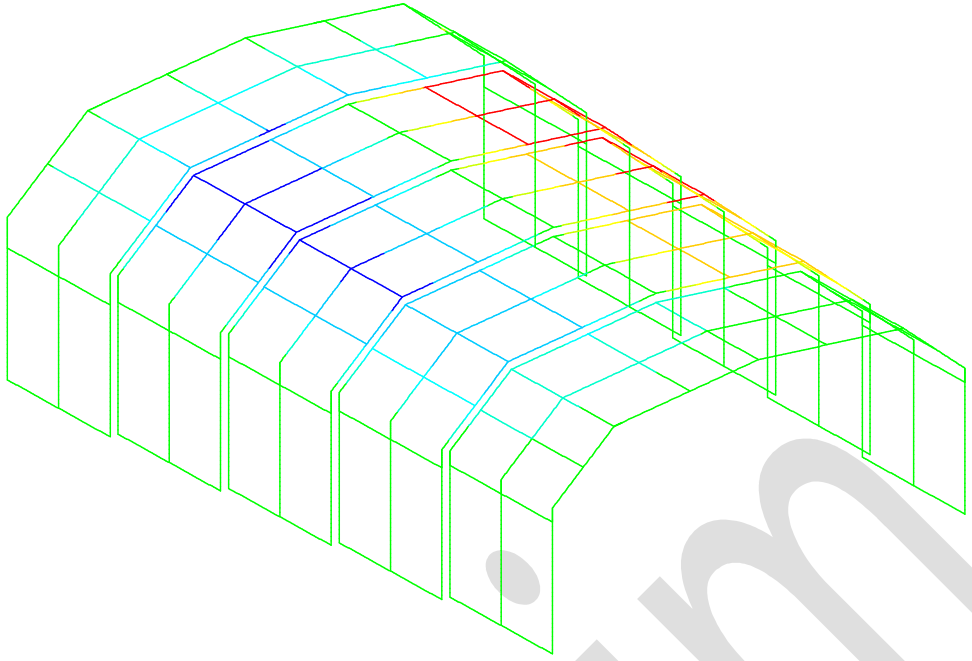
组合10 (恒0+0.7雪1+风4) Uz:mm (整体)



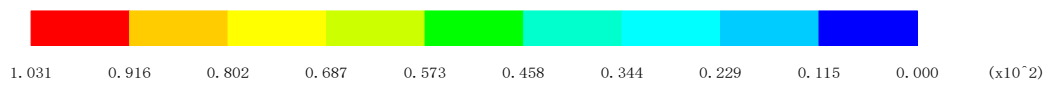
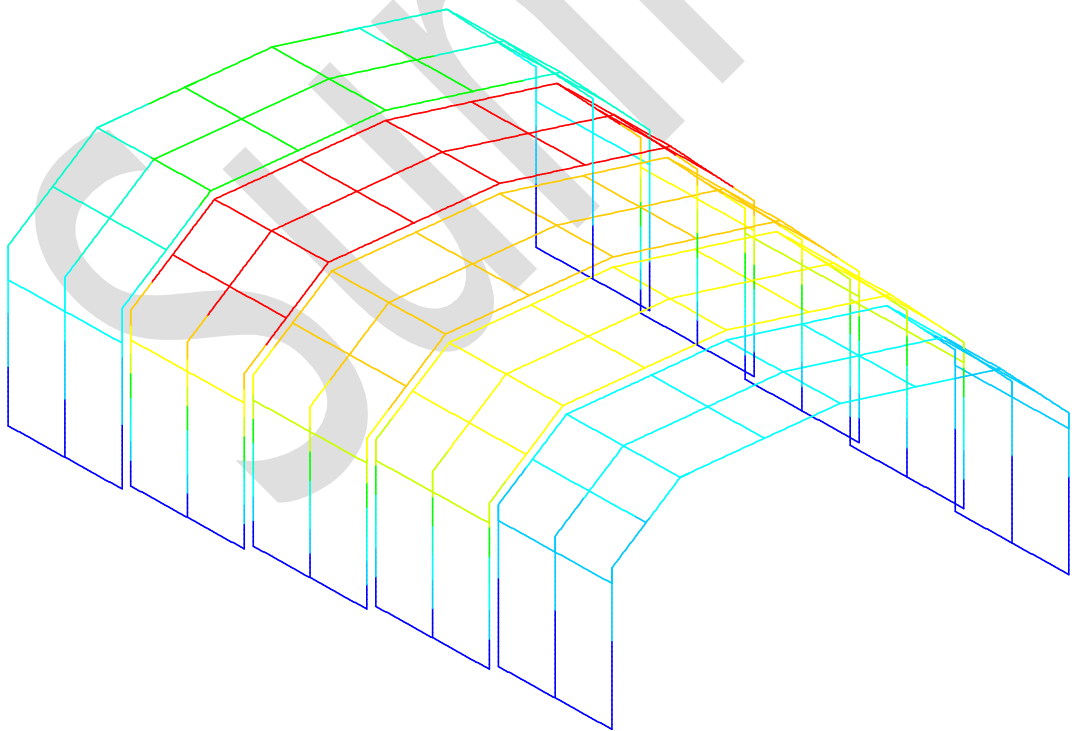
组合10 (恒0+0.7雪1+风4) Uxyz:mm (整体)



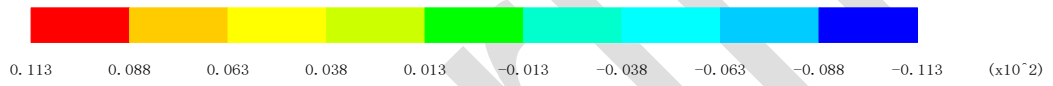
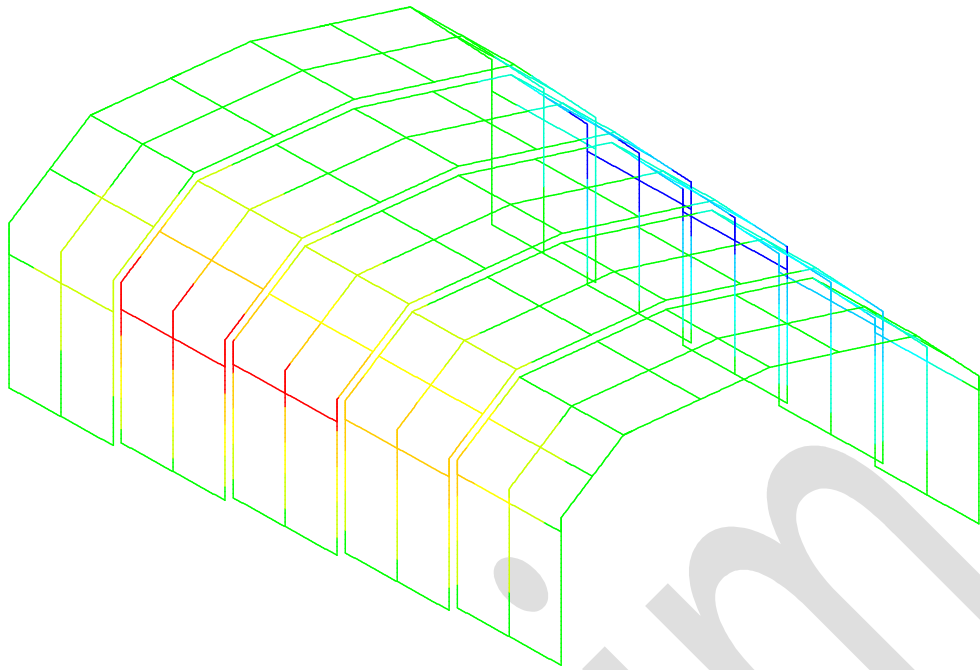
组合11 (恒0+风2) Ux:mm (整体)



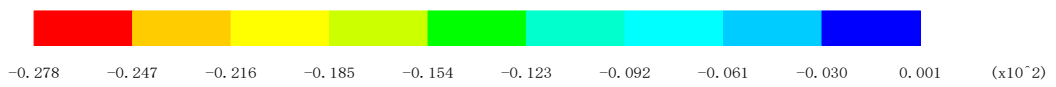
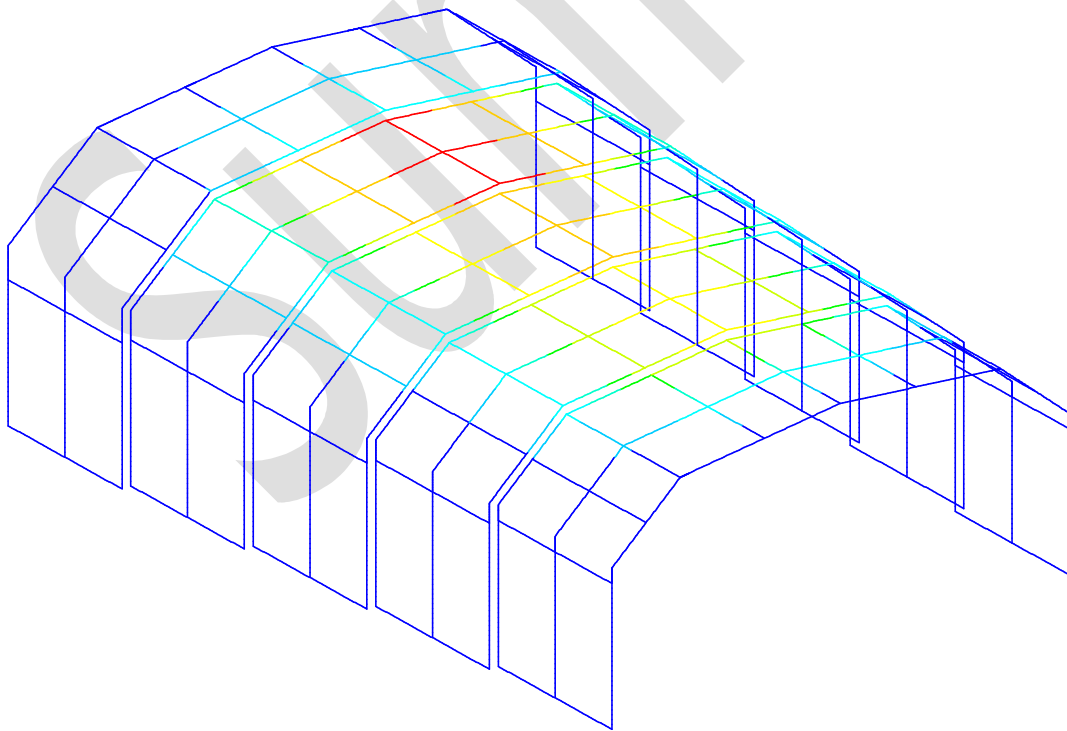
组合11 (恒0+风2) Uz:mm (整体)



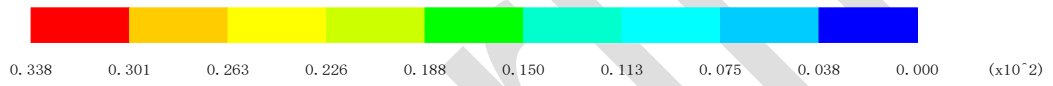
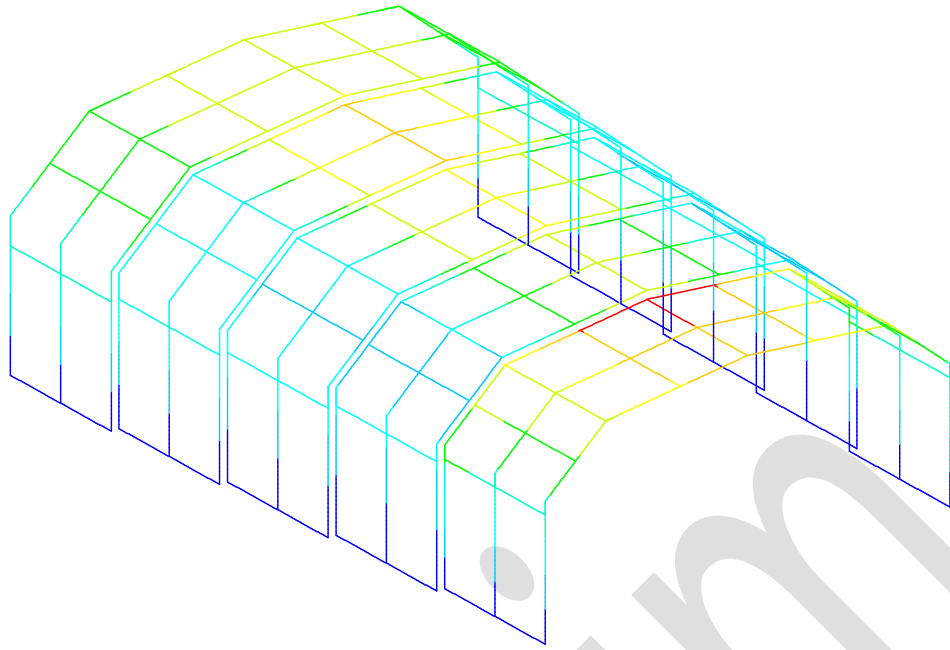
组合11 (恒0+风2) Uxyz:mm (整体)



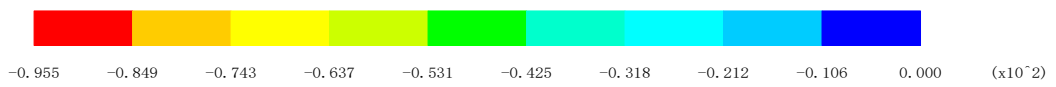
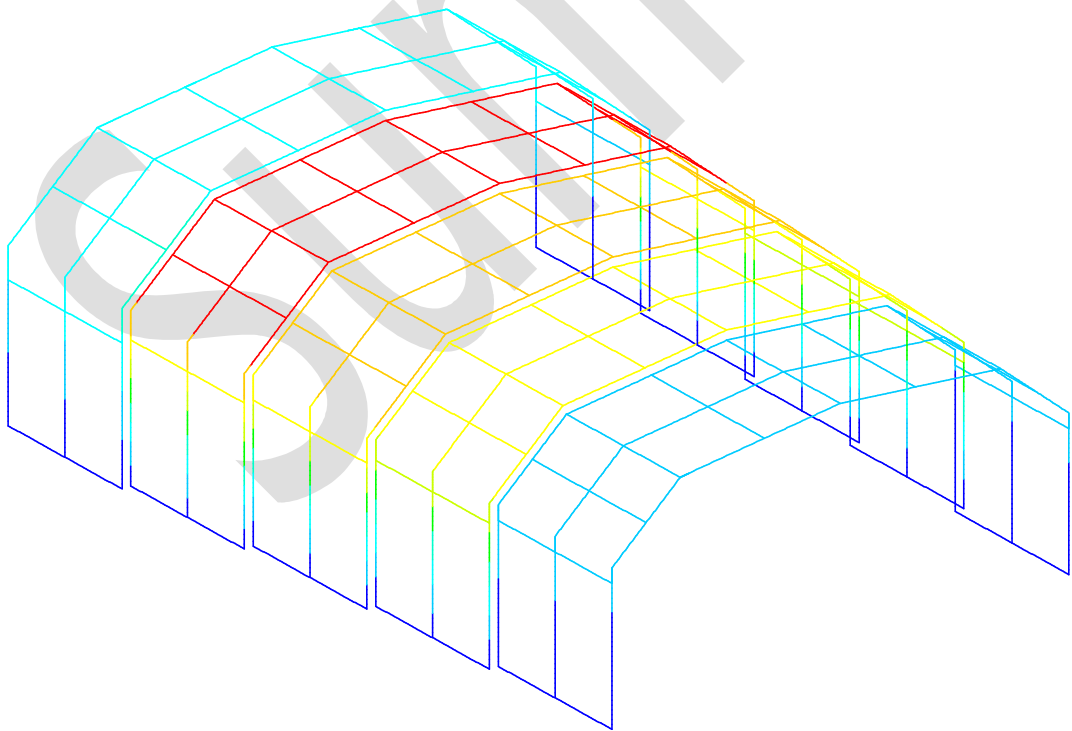
组合12 (恒0+风3) Ux:mm (整体)



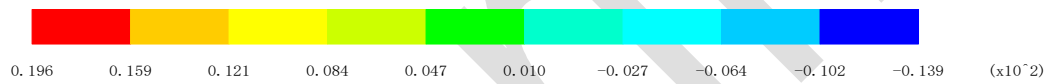
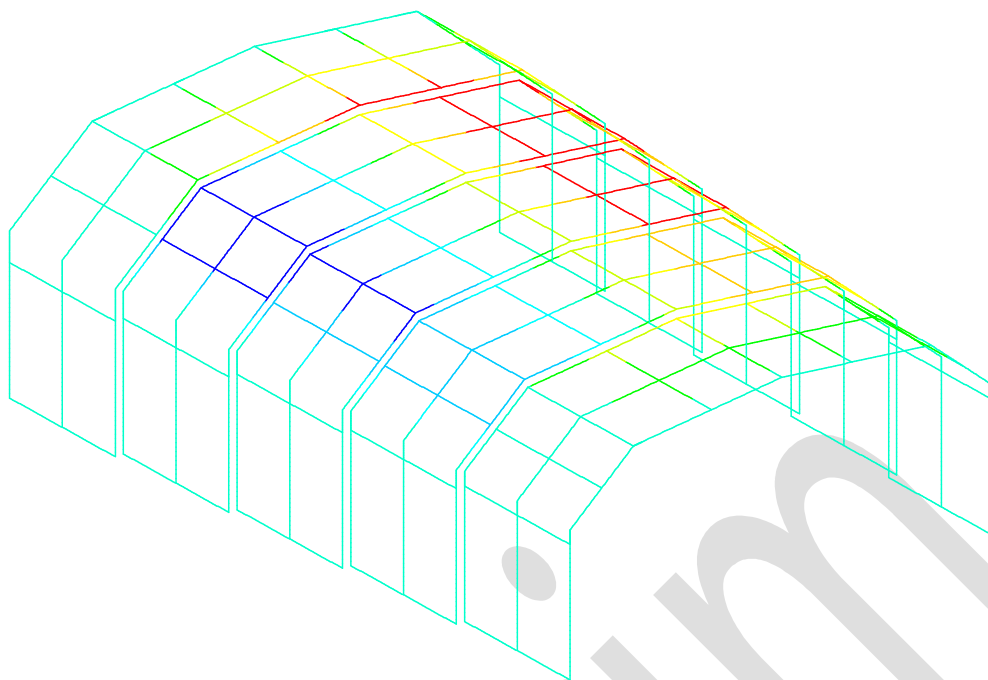
组合12 (恒0+风3) Uz:mm (整体)



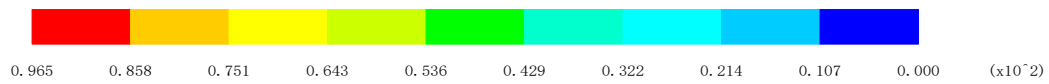
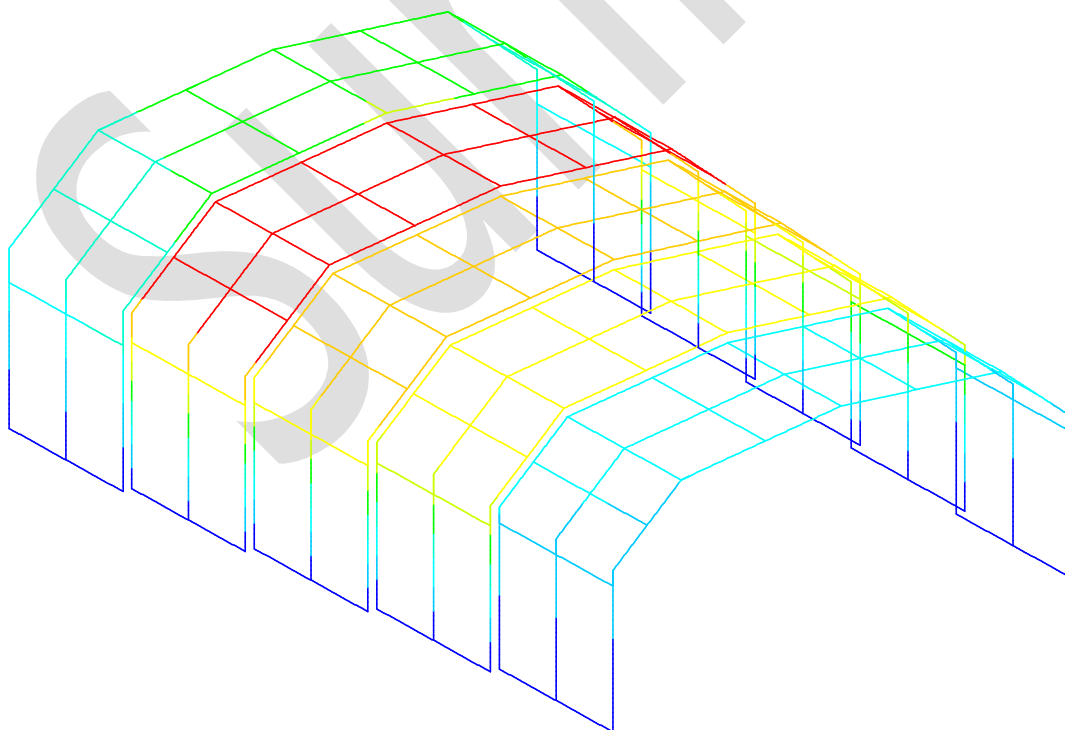
组合12 (恒0+风3) Uxyz:mm (整体)



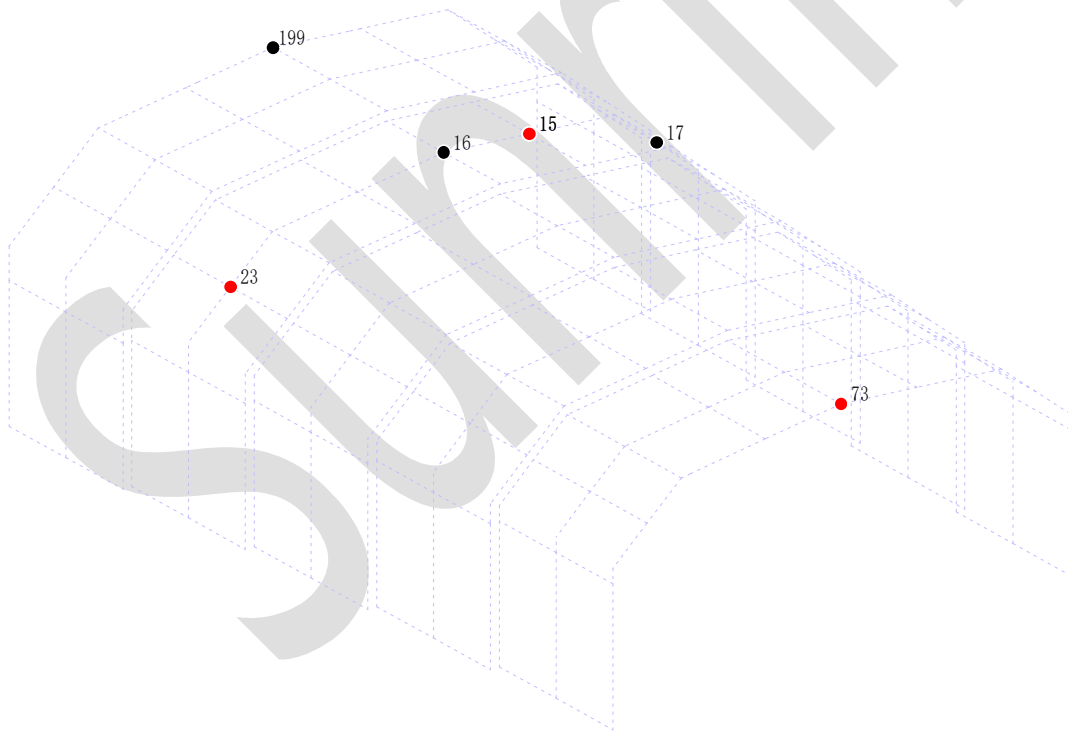
组合13 (恒0+风4) Ux:mm (整体)



组合13 (恒0+风4) Uz: mm (整体)



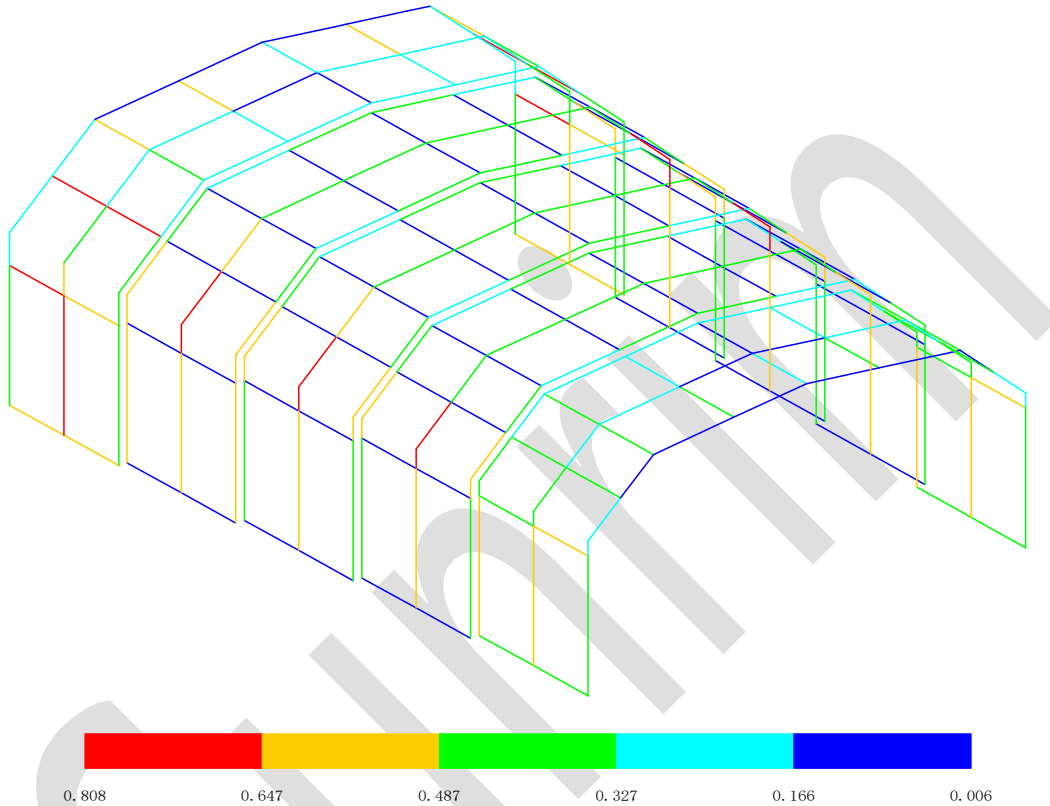
线性组合最大最小位移表						
最不利项	节点	组合名	U _x	U _y	U _z	U _{xyz}
X方向位移最大	23	组合8 (恒0+0.7雪1+风2)	105.420	-0.000	8.104	105.731
Y方向位移最大	73	组合3 (恒0+风4)	-14.619	22.265	-0.017	26.636
Z方向位移最大	15	组合3 (恒0+风4)	-94.303	-0.000	19.579	96.314
空间位移最大	15	组合8 (恒0+0.7雪1+风2)	100.331	0.000	-42.186	108.839
X方向位移最小	17	组合10 (恒0+0.7雪1+风4)	-97.155	-0.000	8.028	97.486
Y方向位移最小	199	组合3 (恒0+风4)	-25.898	-42.333	-0.037	49.626
Z方向位移最小	16	组合6 (恒0+雪1+0.6风3)	0.000	0.000	-73.025	73.025



线性组合最大最小位移图（整体）

7 设计验算

7.1 验算结果

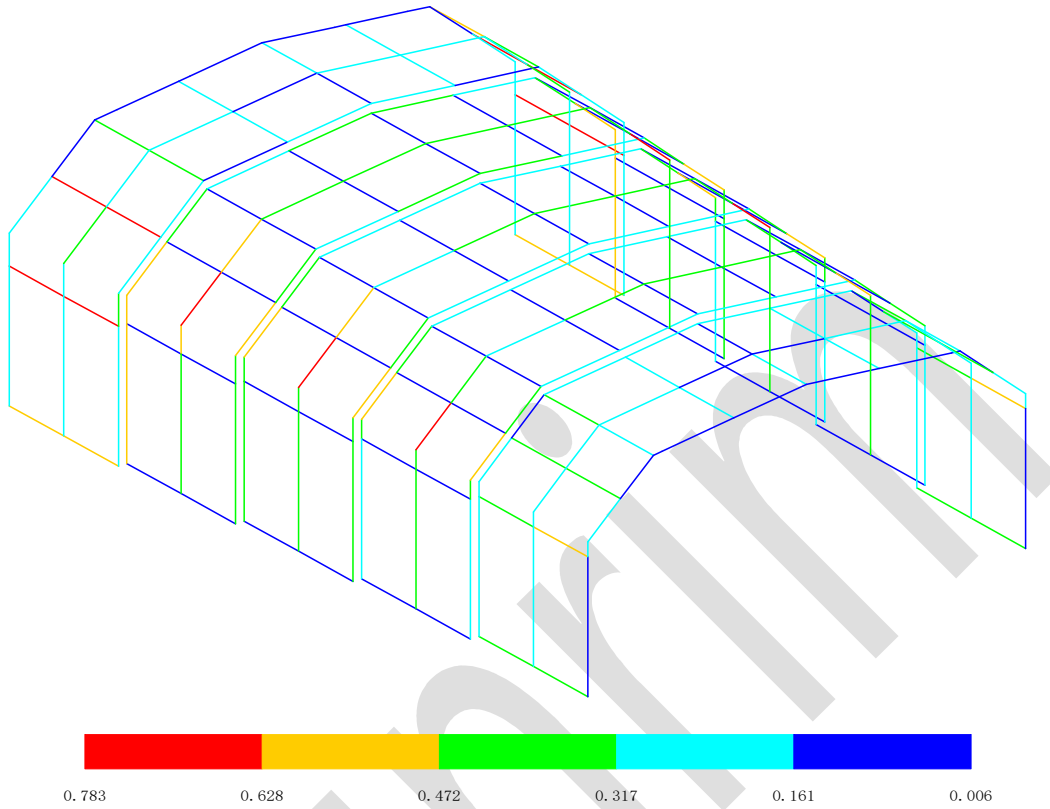


按“强度应力比”显示构件颜色（整体）

“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）

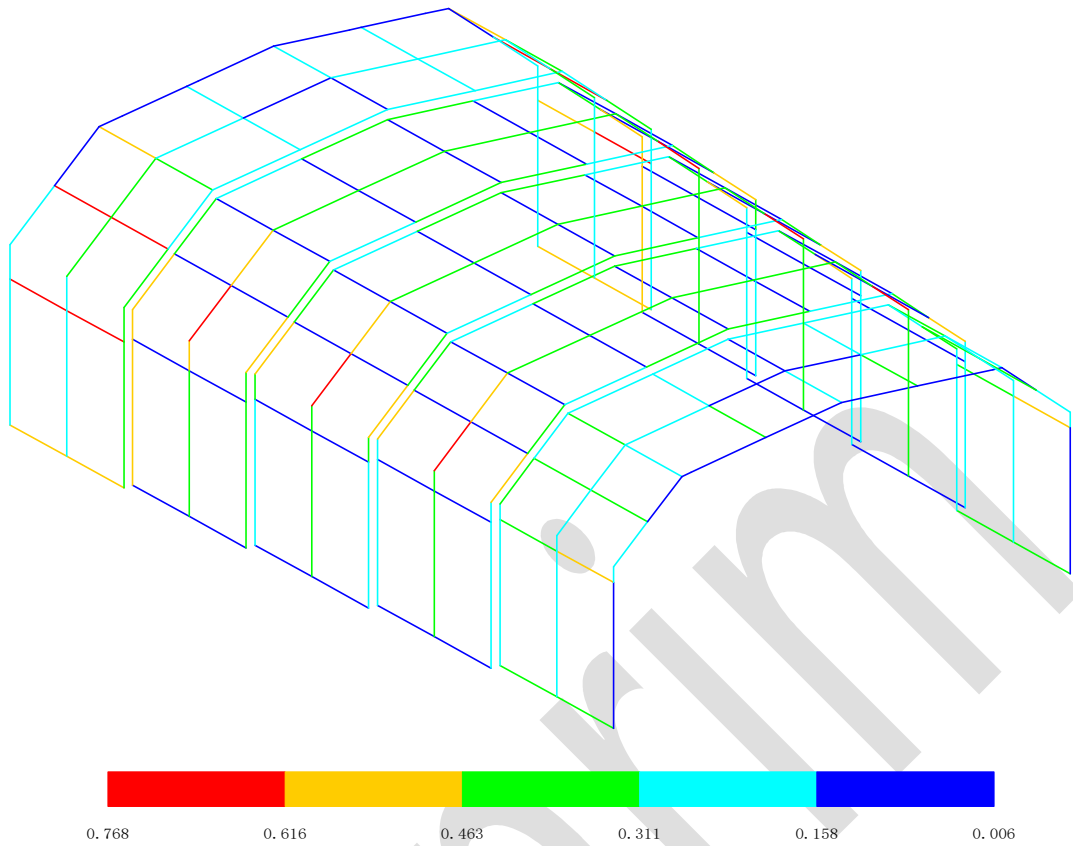
序号	单元号	强度	绕2轴整体稳定	绕3轴整体稳定	沿2轴抗剪应力比	沿3轴抗剪应力比	沿2轴长细比	沿3轴长细比	结果
1	136	0.808 (8/1)	-	-	0.015	0.034	43	37	满足
2	138	0.791 (10/1)	-	-	0.015	0.034	43	37	满足
3	112	0.788 (8/1)	-	-	0.022	0.019	56	49	满足
4	122	0.788 (10/1)	-	-	0.022	0.018	56	49	满足
5	182	0.768 (5/1)	-	-	0.012	0.000	15	13	满足
6	180	0.766 (5/1)	-	-	0.015	0.000	33	28	满足
7	194	0.718 (5/1)	-	-	0.012	0.000	13	11	满足
8	176	0.717 (7/1)	-	-	0.012	0.000	15	13	满足

9	192	0.716 (5/1)	-	-	0.015	0.000	31	26	满足
10	174	0.715 (7/1)	-	-	0.015	0.000	33	28	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	136	0.808	-	-	0.015	0.034	43	37	满足
2	180	0.766	-	-	0.015	0.000	33	28	满足
3	112	0.788	-	-	0.022	0.019	56	49	满足
4	122	0.788	-	-	0.022	0.018	56	49	满足
5	192	0.716	-	-	0.015	0.000	31	26	满足
6	174	0.715	-	-	0.015	0.000	33	28	满足
7	121	0.705	-	-	0.022	0.014	56	49	满足
8	111	0.701	-	-	0.021	0.014	56	49	满足
9	138	0.791	-	-	0.015	0.034	43	37	满足
10	204	0.668	-	-	0.014	0.000	29	25	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	180	0.766	-	-	0.015	0.000	33	28	满足
2	112	0.788	-	-	0.022	0.019	56	49	满足
3	122	0.788	-	-	0.022	0.018	56	49	满足
4	192	0.716	-	-	0.015	0.000	31	26	满足
5	174	0.715	-	-	0.015	0.000	33	28	满足
6	121	0.705	-	-	0.022	0.014	56	49	满足
7	111	0.701	-	-	0.021	0.014	56	49	满足
8	136	0.808	-	-	0.015	0.034	43	37	满足
9	204	0.668	-	-	0.014	0.000	29	25	满足
10	186	0.668	-	-	0.015	0.000	31	26	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108mm，恒载情况下，结构最大跨中挠度21mm。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。