

BS Outer frame

Comparison of deformation with and without reinforcement

Create: 2021.9.17

Update: 2021.9.24

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2. Natural frequency
3. Tilt of the oplev platform when weight is applied to the frame
4. Summary and Comment

内容

1. BS本体荷重による沈み込み
2. 固有振動数
3. フレームに体重をかけたときのOplev台の傾き
4. まとめ

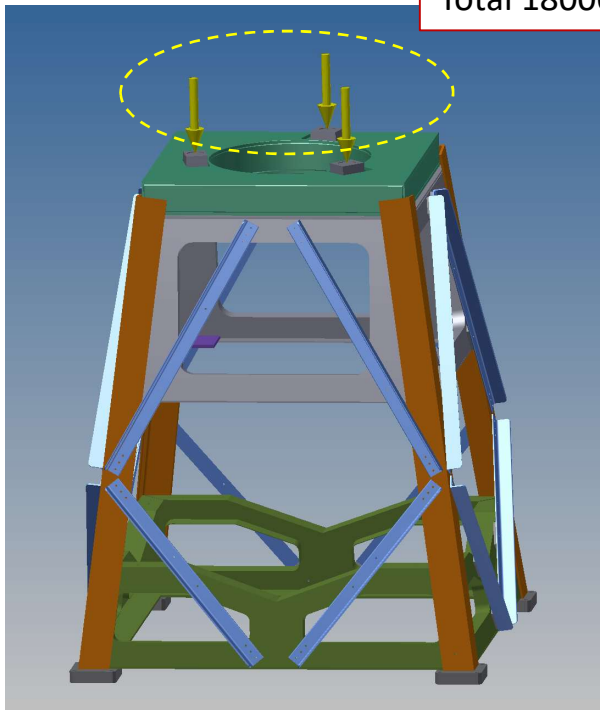
Corrections on 2021.9.24

1. In the reinforced analysis model, three connections between parts were lost. So the reinforced model was modified and the **calculation was redone**.
2. The direction of the load in the analysis of the case where a human's weight putting on it was slightly off from vertical. So, **the calculation was redone for both models**.

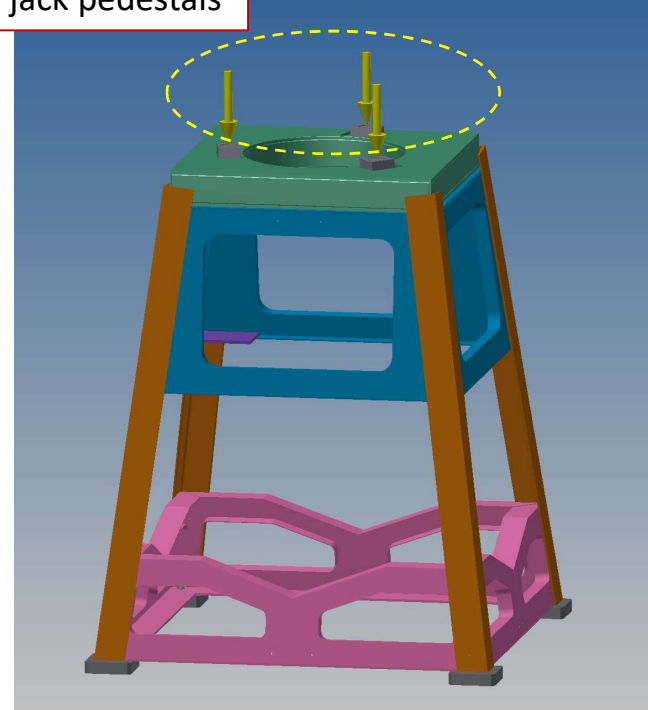
1. Deformation due to BS body load

Analysis model, load conditions

Total 18000N (BS tower) on jack pedestals



Outer frame with reinforcement

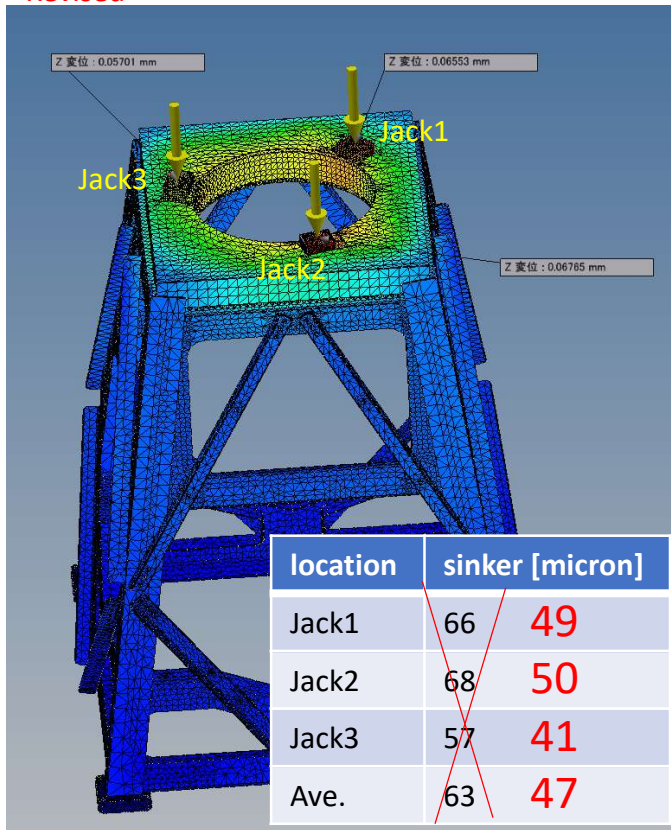


Current outer frame

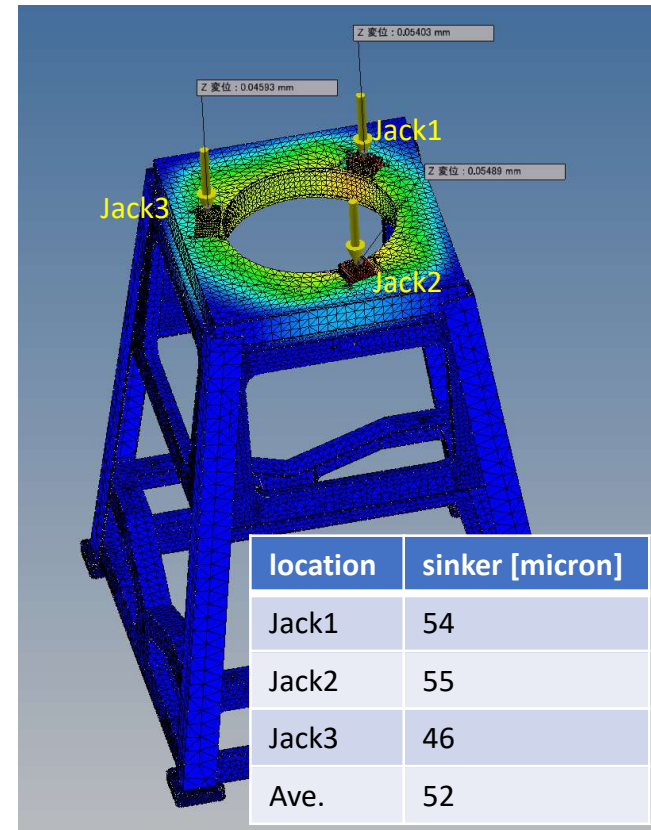
1. Deformation due to BS body load

Result (amount of sinker)

2021.9.24
Revised



Outer frame with reinforcement



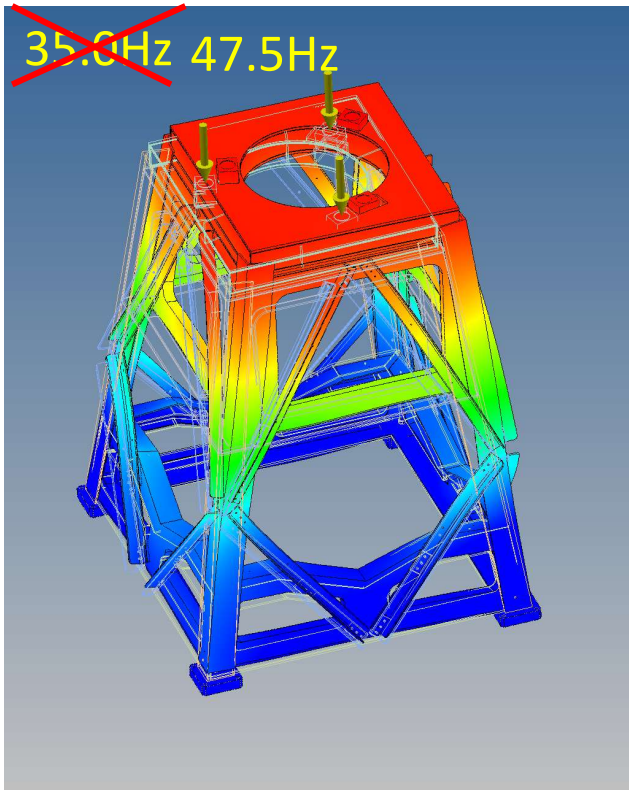
Current outer frame

~~For some reason, the deformations were larger when the model was reinforced. No obvious flaws found in the model.~~

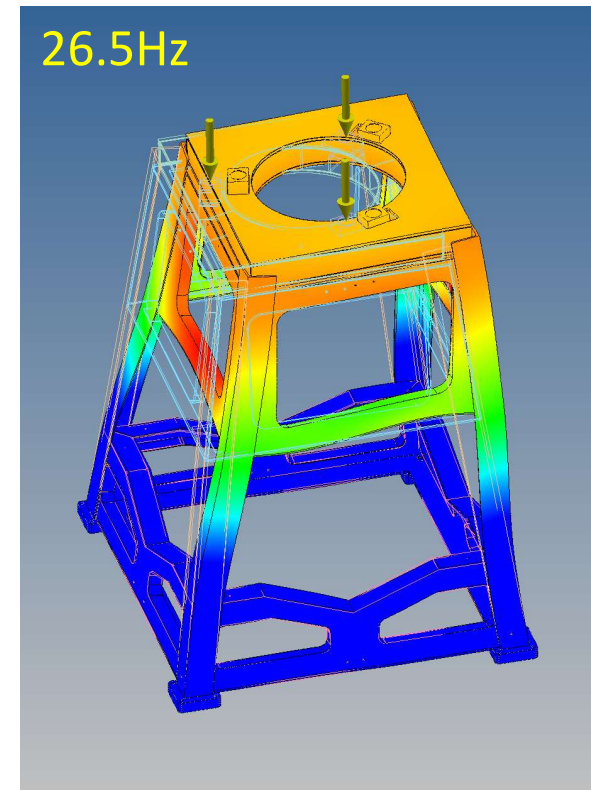
2. Natural frequency

Result (primary mode)

2021.9.24
Revised



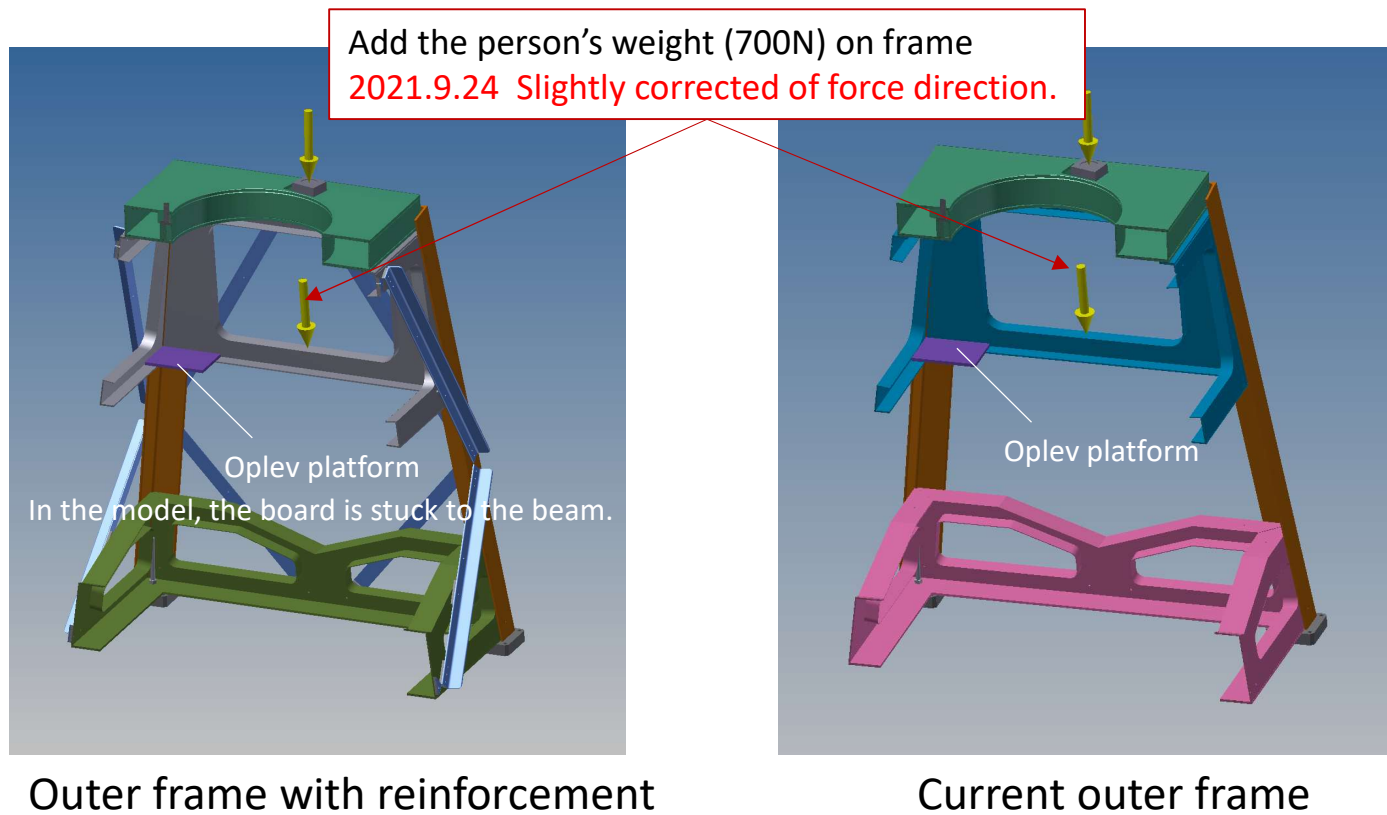
Outer frame with reinforcement



Current outer frame

The natural frequency shows the effect of reinforcement.

3. Tilt of the oplev platform when weight is applied to the frame Analysis model, load conditions



3. Tilt of the oplev platform when weight is applied to the frame

Result

2021.9.24
Revised

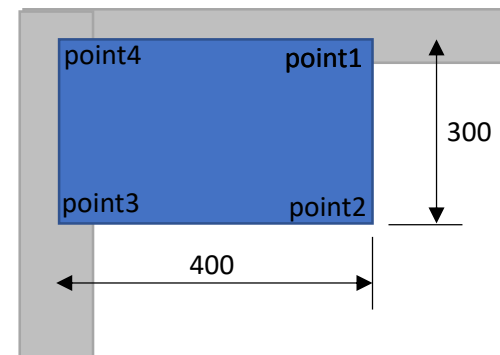
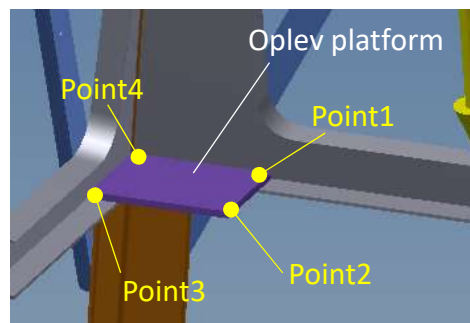
Change in the amount of sinkage when a load is applied by a person

Outer frame with reinforcement

location		sinker [micron]	
Oplev	Point1	2.4	1.9
	Point2	5.2	5.3
	Point3	1.6	0.6
	Point4	1.5	0.4
Jack	Jack1	0.4	0
	Jack2	0.5	0.1
	Jack3	1.1	0.1

Current outer frame

location		sinker [micron]	
Point1	1.5	2.5	
Point2	6.8	10.1	
Point3	0.5	0.6	
Point4	0.7	0.9	
Jack1	0.1	-0.3	
Jack2	0.1	0.1	
Jack3	0.2	0.2	



4. Summary and comment

Comparison results with and without reinforcement

- The reinforcement reduces the displacement the jack. The amount is about a few microns.
- The natural frequency will be higher with reinforcement.
- When a person's weight is applied, only very small changes (a few microns) are seen in both Jack and Oplev.
- The model is supposed to be a bit more rigid than the real thing, as the parts are properly connected to each other.

5. Reference

Detail of change in the displacement due to BS body load (no weight of person)

2021.9.24
Revised

Direction X

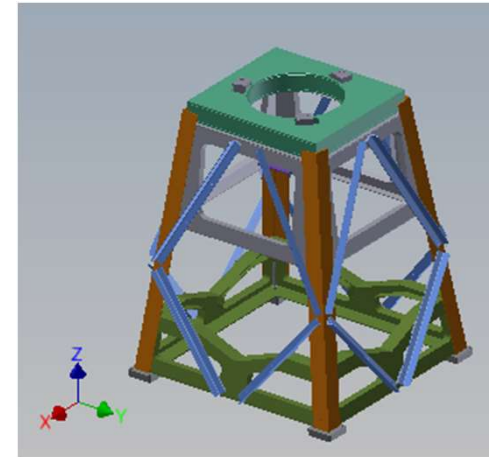
dX	With reinforced		Current frame
Jack1	8.5	10.8	7.6
Jack2	3.1	4.6	2.4
Jack3	2	4.2	1.3
			[micron]

Direction Y

dY	With reinforced		Current frame
Jack1	11.5	11.3	11
Jack2	7.8	8.5	8
Jack3	2.3	2.9	1.5
			[micron]

Direction Z

dZ	With reinforced		Current frame
Jack1	49.2	65.5	54
Jack2	50.4	67.7	54.9
Jack3	40.7	57	45.9
Ave.	46.8	63.4	51.6
			[micron]



5. Reference

Detail of change in the displacement when a load is applied by a person

2021.9.24

Revised

補強無し Current frame					補強あり with reinforcement				
		基本荷重	体重あり	移動量			基本荷重	体重あり	移動量
		Only BS	Add person's weight	displacement			Only BS	Add person's weight	displacement
point1	dx	3.3	0.4	-2.9[micron]	point1	dx	4.9	3.8	-1.1 [mi
	dy	0.1	0.9	0.8		dy	1.4	1.3	-0.1
	dz	3.9	6.4	2.5		dz	3.5	5.4	1.9
point2	dx	3.3	0.7	-2.6	point2	dx	4.8	3.8	-1
	dy	0.3	0.4	0.1		dy	0.7	0.8	0.1
	dz	2.9	13	10.1		dz	1.8	7.1	5.3
point3	dx	1.1	0.5	-0.6	point3	dx	1.3	0.8	-0.5
	dy	0.3	0.1	-0.2		dy	0.7	0.6	-0.1
	dz	5	5.6	0.6		dz	4.1	4.7	0.6
point4	dx	1.1	0.5	-0.6	point4	dx	1.3	0.9	-0.4
	dy	1.3	0.9	-0.4		dy	1.6	1.3	-0.3
	dz	4.6	5.5	0.9		dz	4.2	4.6	0.4
フレーム	z		42.3	42.3	フレーム	z	0.7	32.4	31.7
Jack1	z	54	53.7	-0.3	Jack1	z	49.2	49.2	0
Jack2	z	54.9	55	0.1	Jack2	z	50.4	50.5	0.1
Jack3	z	45.9	46.1	0.2	Jack3	z	40.7	40.8	0.1

