

About Spoke Wheel (1)
10 April, 2001 tokoku

0, Spoke Wheel

The spoke wheel has 8 thin spokes each machined out of stainless steel. The purpose of the stainless spoke is to concentrate the temperature drop across the spoke. And these are to preload the bearing so that the spokes are deformed outward to absorb the shrinkage of the cooled carousel.

1, Analysis

The figure of the spoke wheel is as follows.

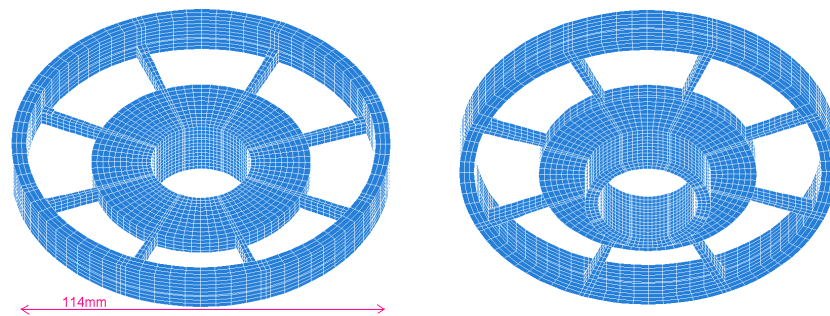


Fig 1 Spoke Wheel (front and back view)

Material : Stainless Steel (SUS405)

Initial Temperature : 293K

Cooling Temperature : 150K

Size : OD 114mm, ID 38mm, Height 26mm

Heat transfer : conduction only

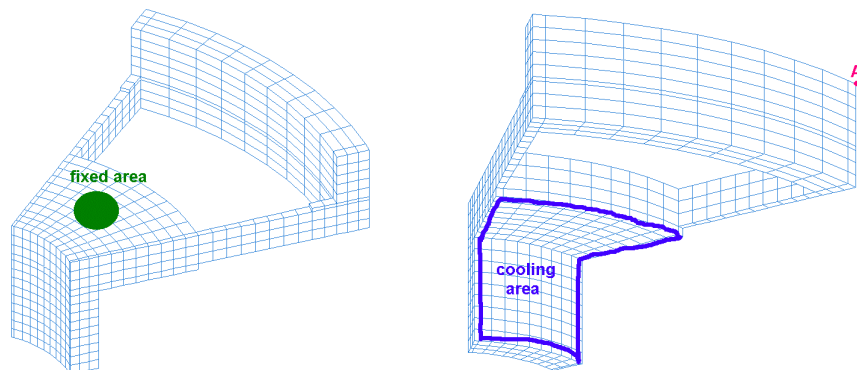


Fig 2 Actual Model (1/8 model)

2, Thermal Conduction

The outer surface of the tubular column is cooled. 60 minutes after, the most distant point from the cooling area (point A on Fig.2) dropped almost the same temperature as the cooling temperature. Radiative transfer is not considered.

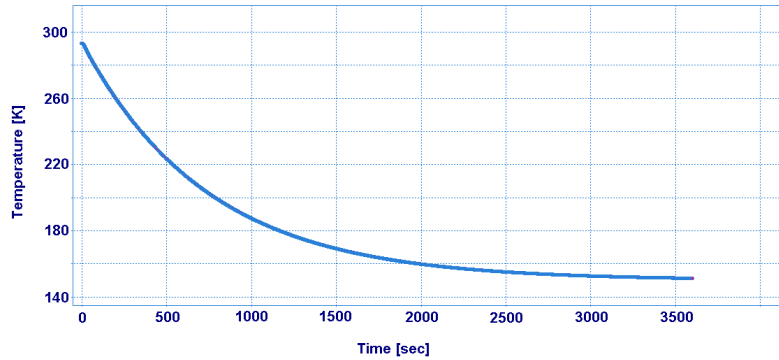


Fig 3 Temperature change

3, Thermal Analysis

The displacements and the Mises stress after 60 min are as follows. The stress is a little large especially around the fixed area.

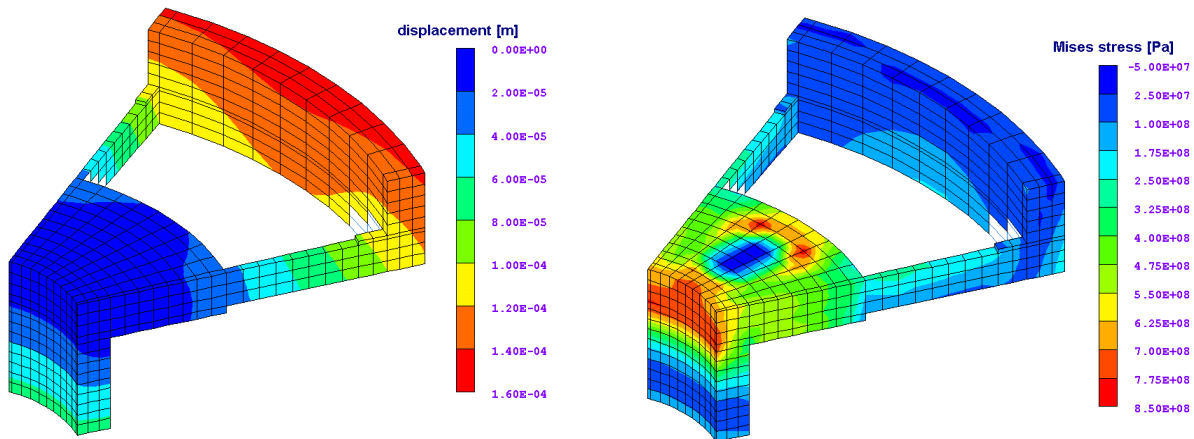


Fig 4 The displacement [m] (left) and the Mises stress by cooling [Pa] (right)

4, Others

The mechanical and thermal properties of stainless steel are as follows. The reference temperature of them is 300K.

	Stainless Steel (SUS405)
Density [kg/m ³]	7800
Elastic Modulus [GPa]	200
Thermal Expansion [10 ⁻⁶ /K]	17.3
Specific Heat [J/kg/K]	0.46
Thermal Conduction [W/m/K]	27