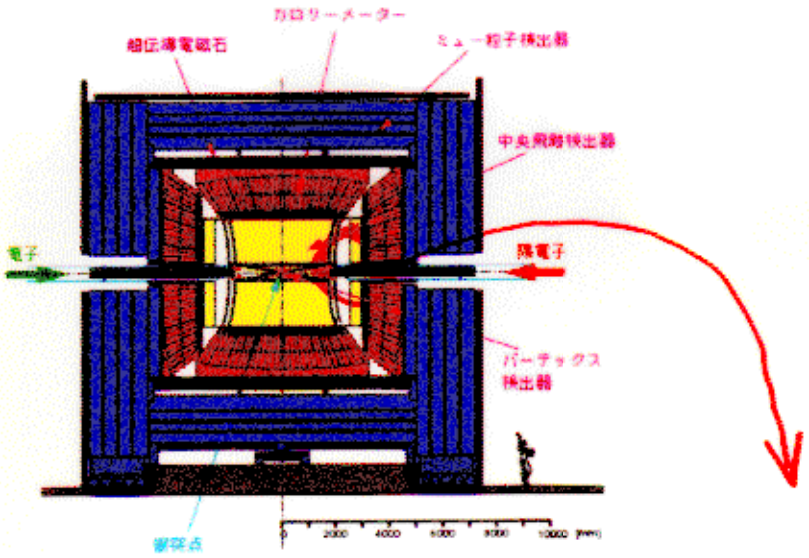
July 22, '99

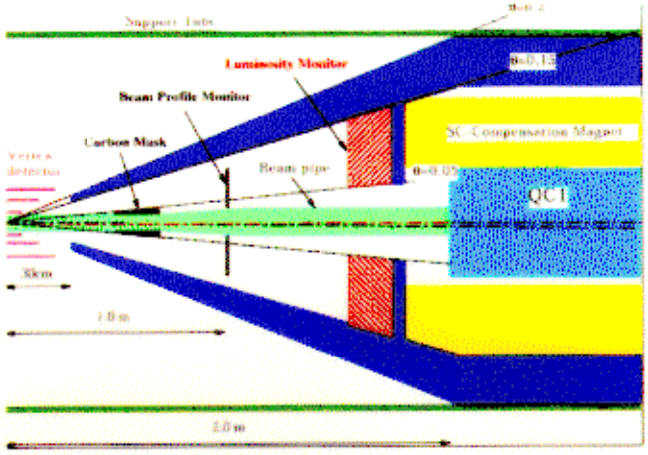
Analysis on support tube
(very preliminary)

KEK Hiroshi Yamaoka

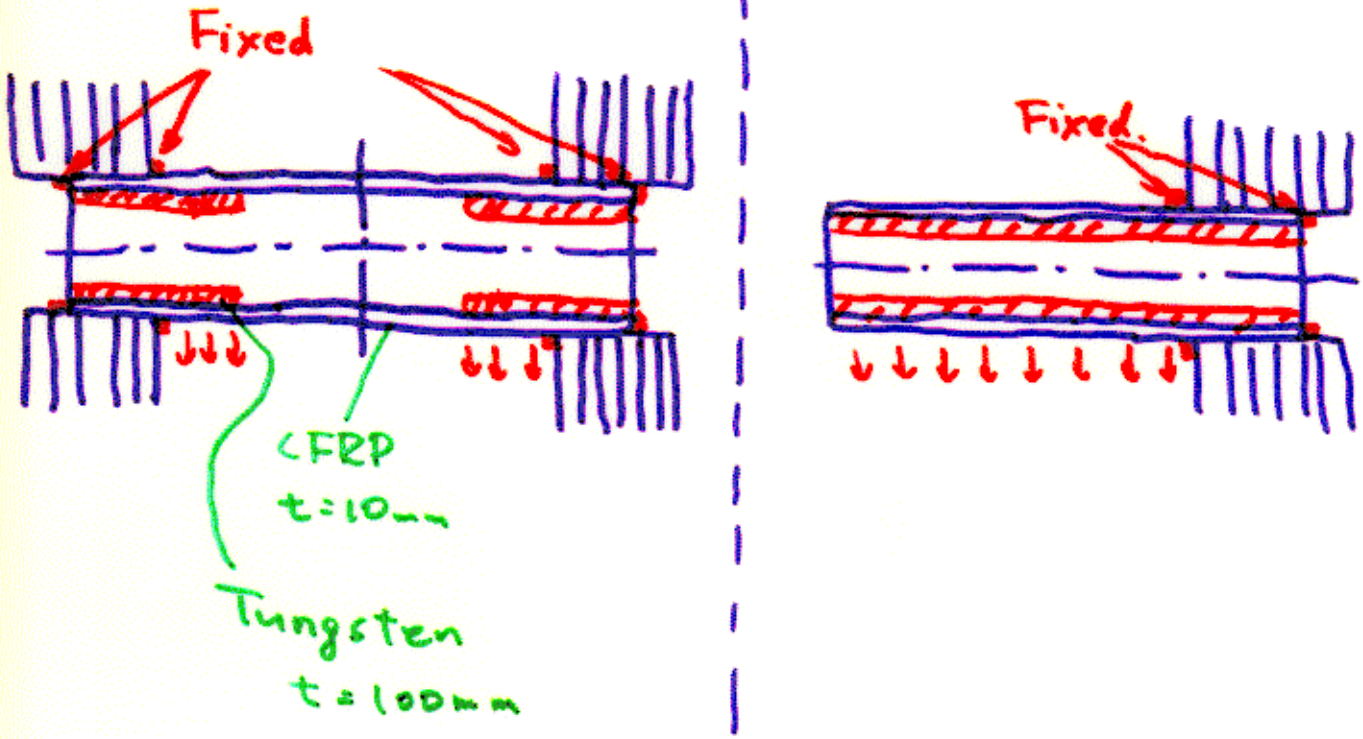
Contents

1. Introduction



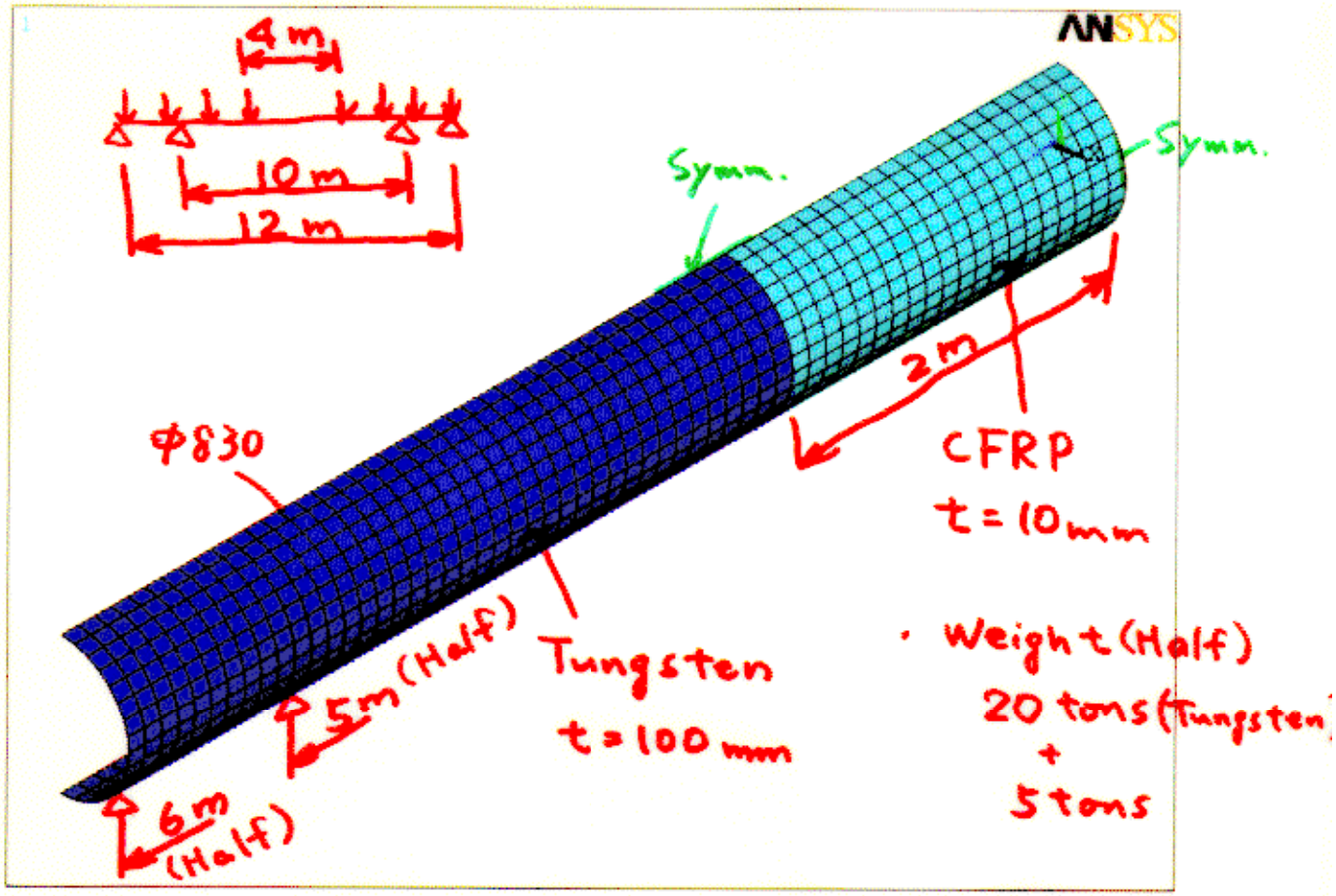


Assumption



2. Static Analysis

(1)-a Simply supported at both ends



O CFRP

Young's modulus: $1.5 \times 10^4 kg/mm^2$(150GPa)

Density : $1.5 \times 10^{-6} kg/mm^2$

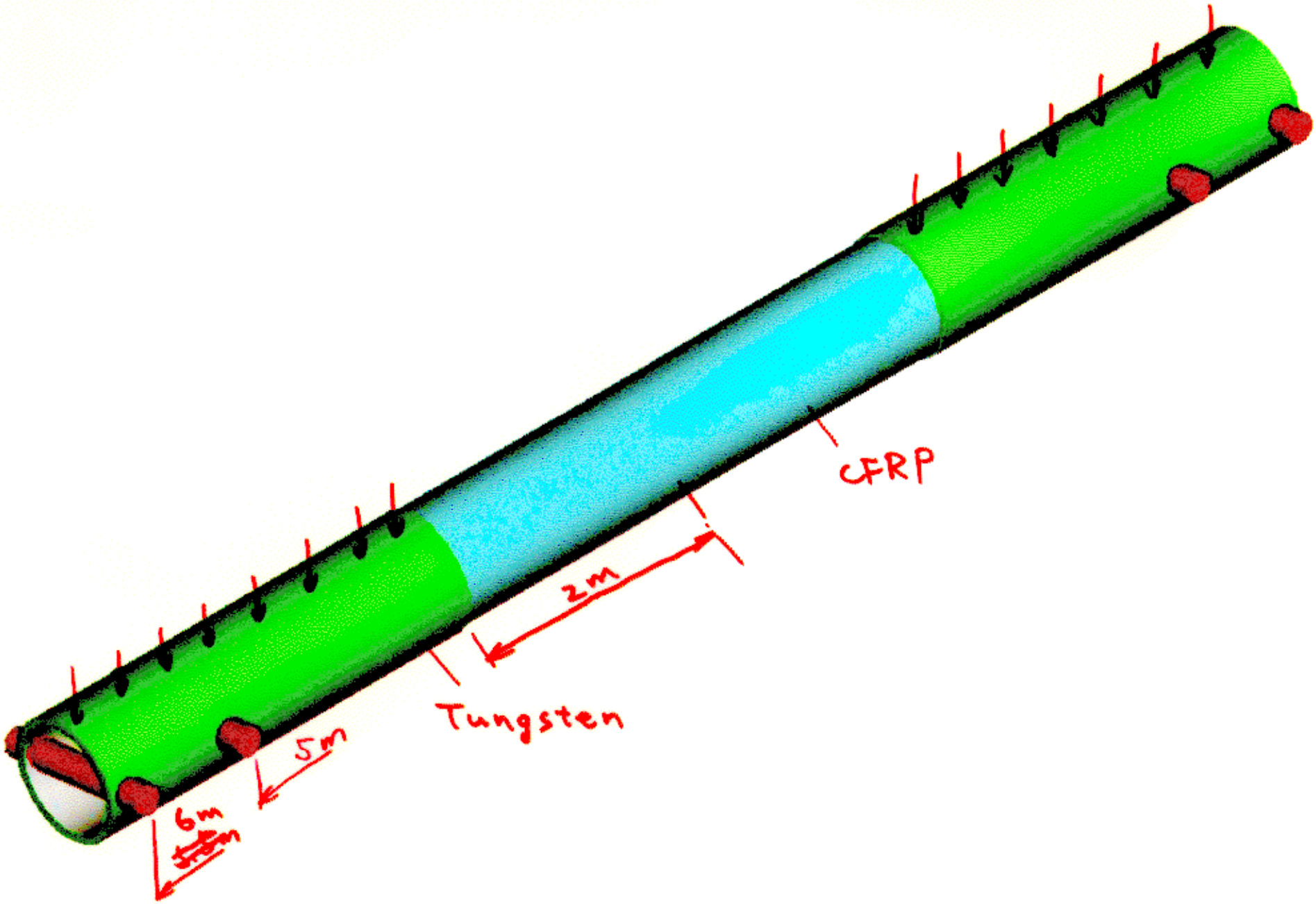
O Tungsten

Young's modulus: $4.15 \times 10^4 kg/mm^2$(415GPa)

Density : $19.3 \times 10^{-6} kg/mm^2$

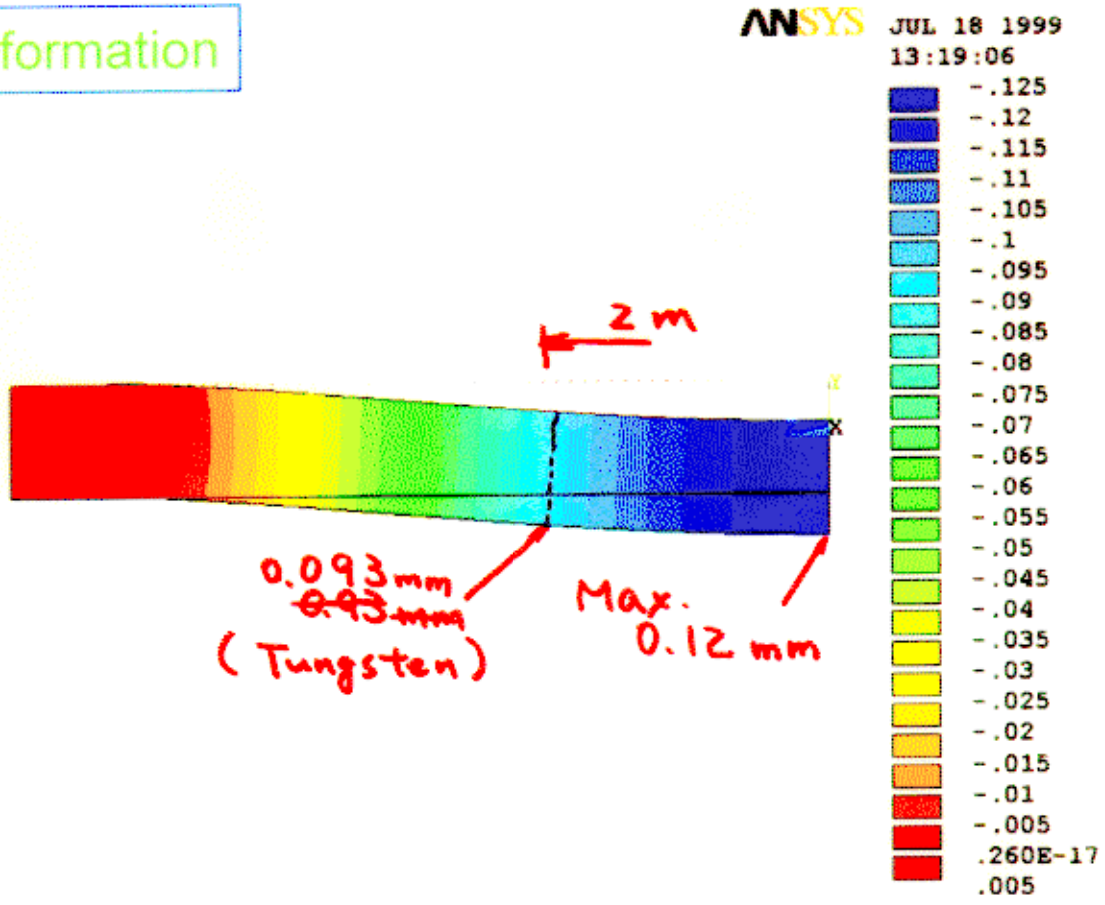
!! Rigidity of Tungsten is taking account.

↳ $D = E_T \cdot I_T$ (Tungsten) + $E_c \cdot I_c$ (CFRP) $I = \frac{\pi (d_o^4 - d_i^4)}{64}$

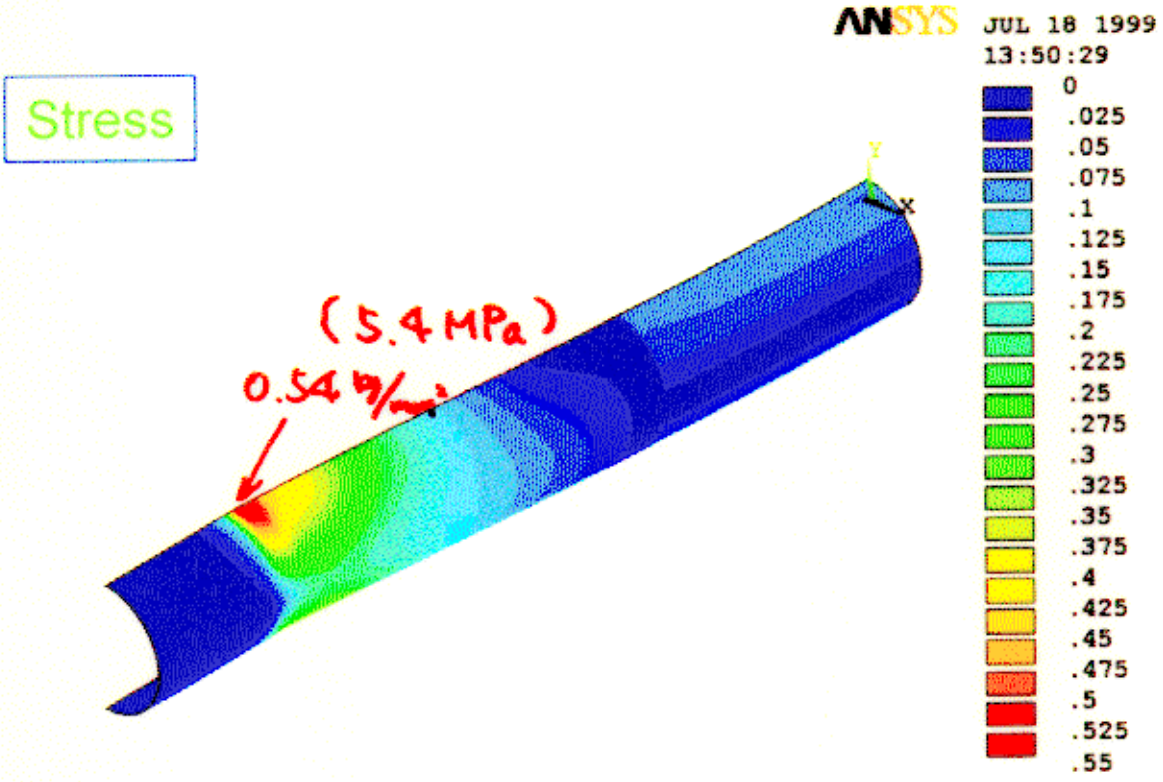

CFRP
2m
Tungsten
5m
6m

(1)-b Results

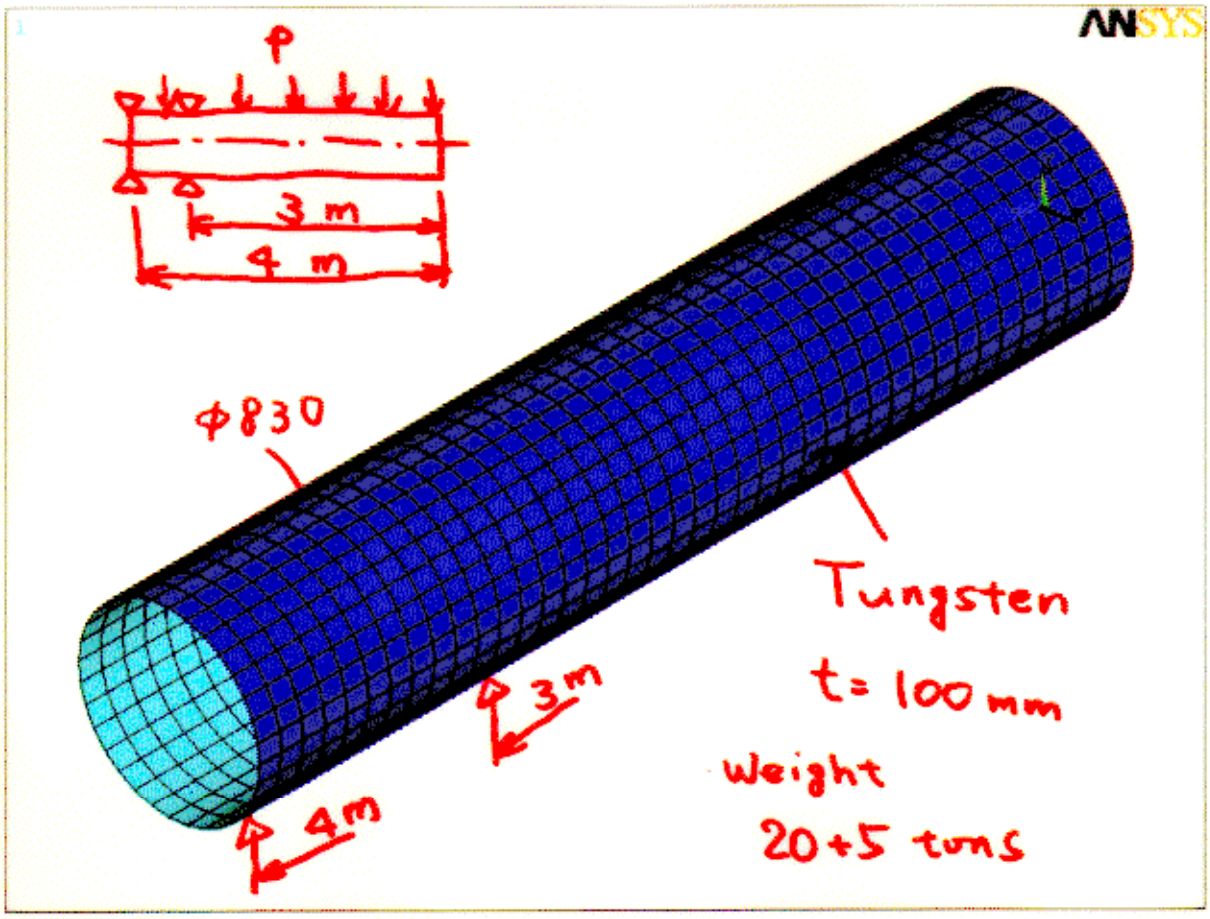
Deformation



Stress



(2)-a Supported at one end(Cantilever)



O Tungsten

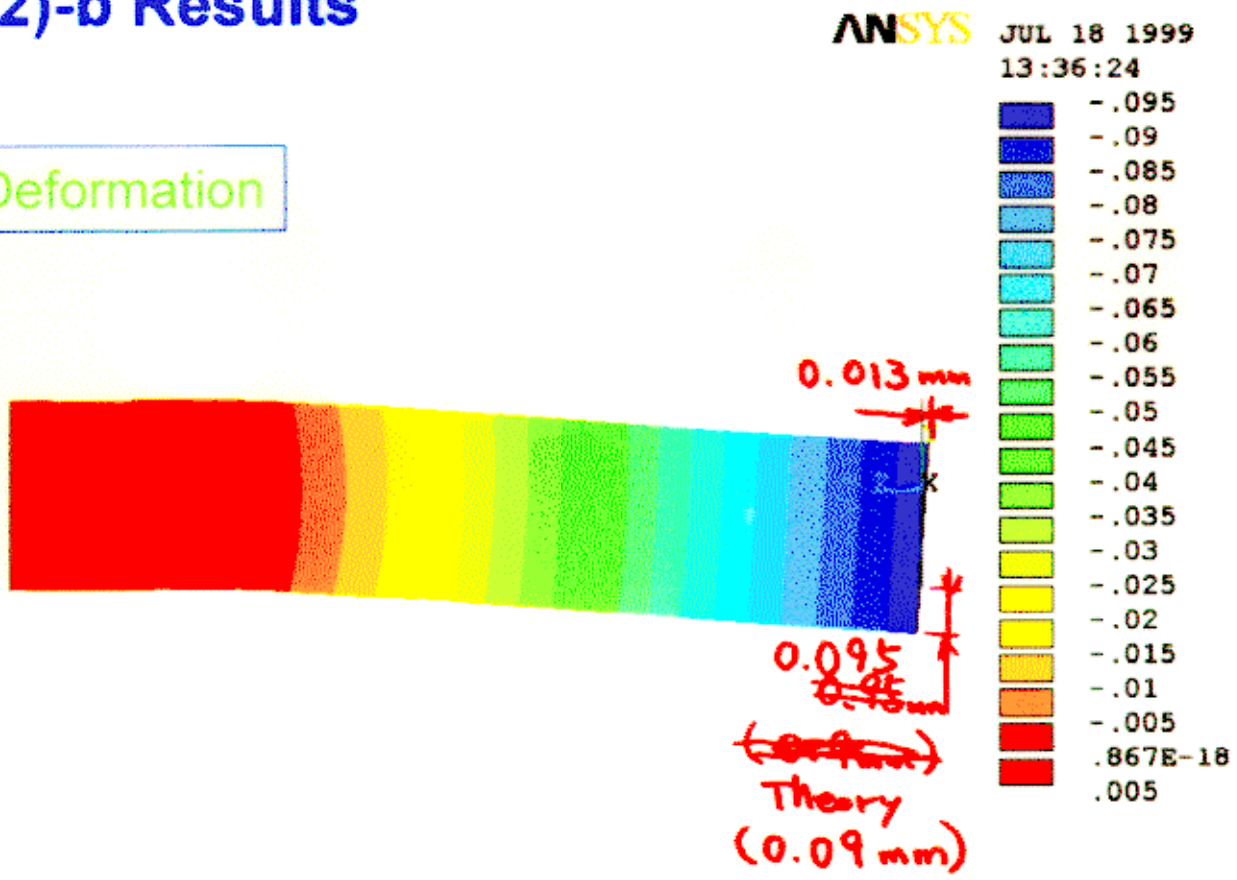
Young's modulus: 4.15×10^{4}kg/mm^2(415GPa)

Density : 19.3×10^{-6}kg/mm^2

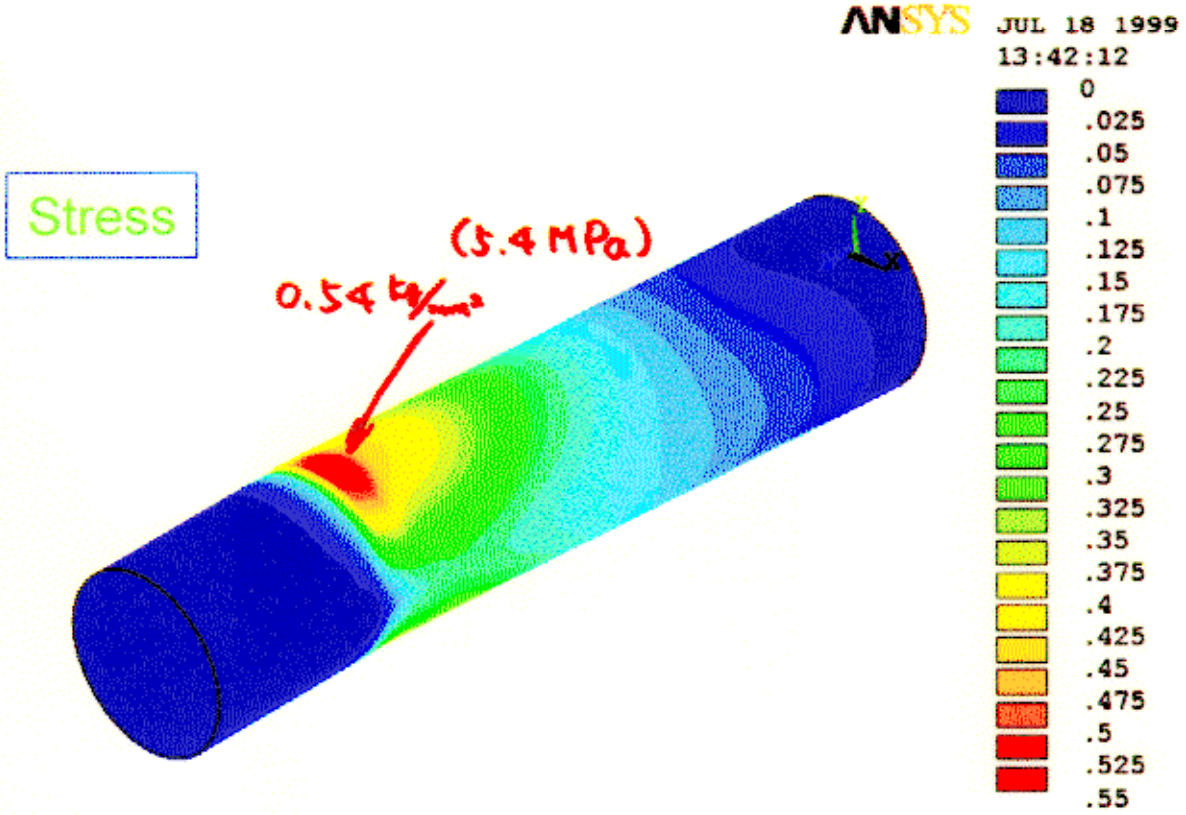
!! Rigidity of Tungsten mask is taking account.

(2)-b Results

Deformation



Stress

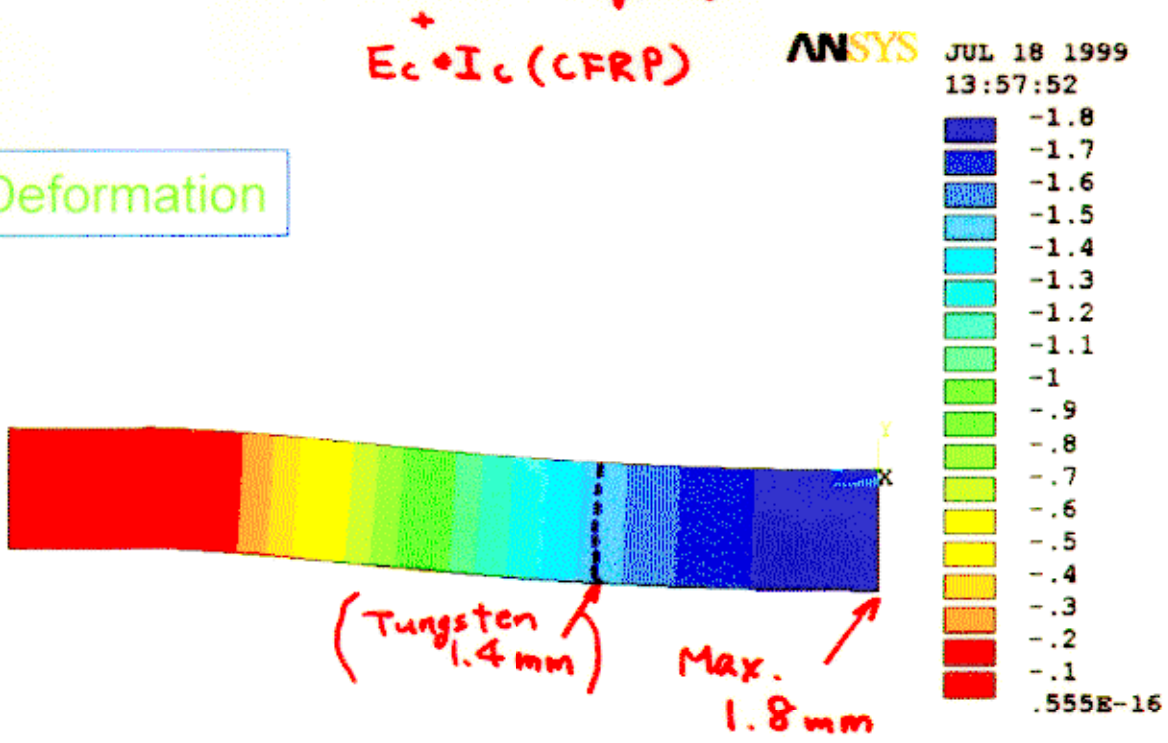


(3) No rigidity of the Tungsten mask

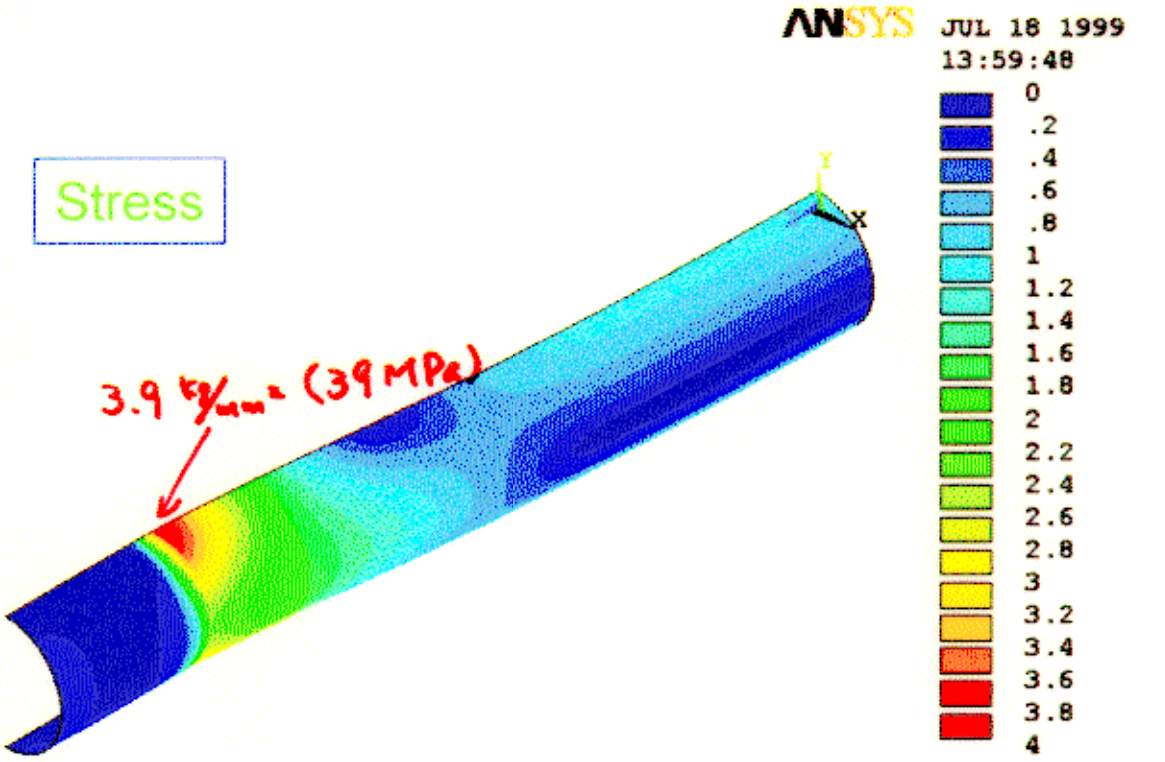
(3)-a Both ends simply fixed.

$D = E_t I_t$ (Tungsten)
$+$
$E_c \cdot I_c$ (CFRP)

Deformation

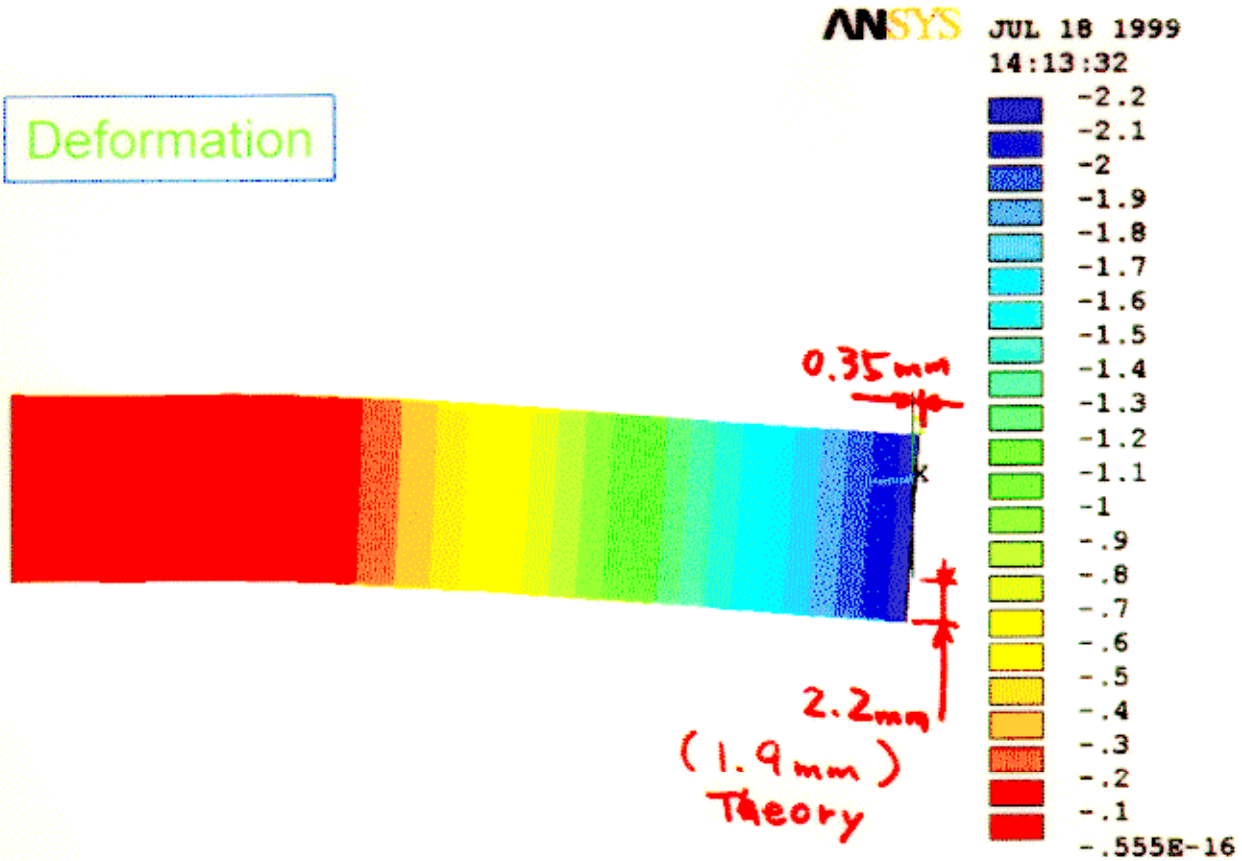


Stress

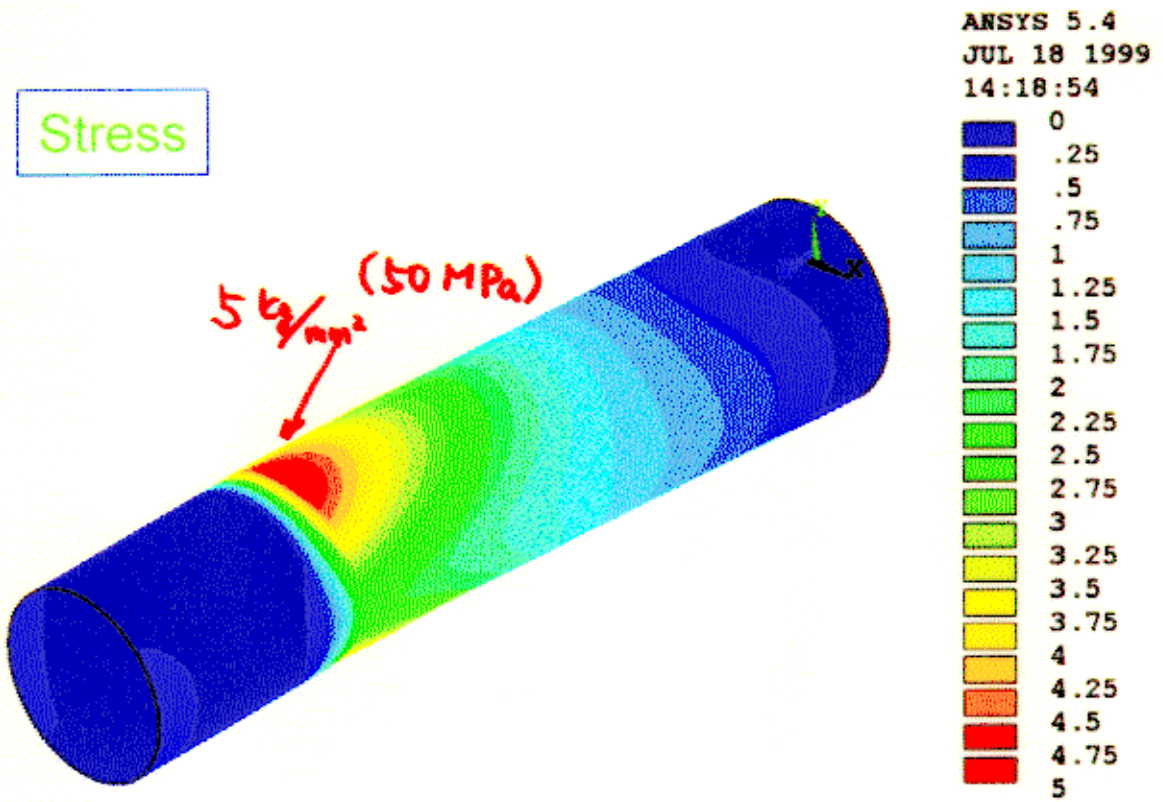


(3)-b One end fixed.

Deformation



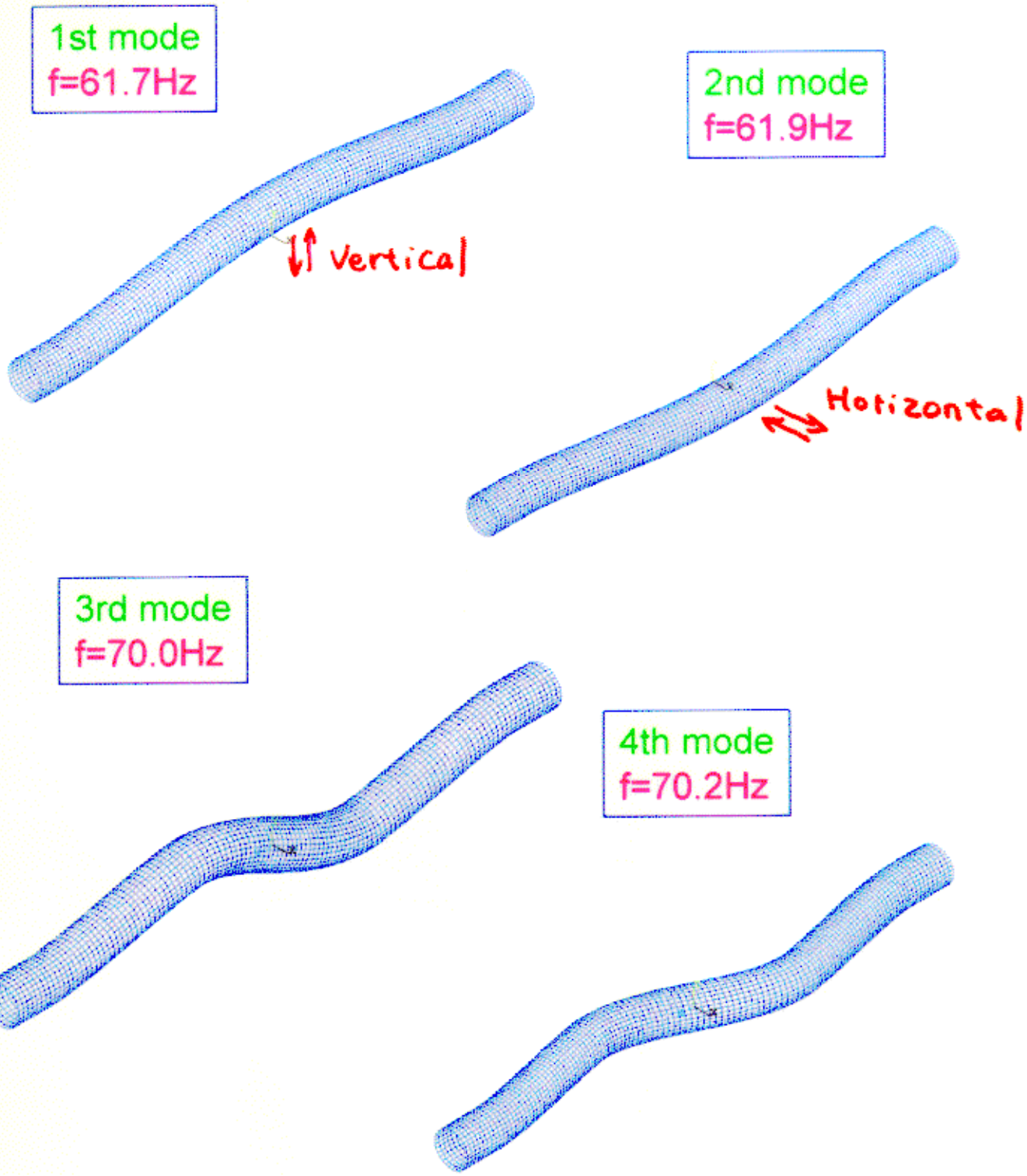
Stress



3. Natural Frequency

(1) In case of rigid Tungsten mask

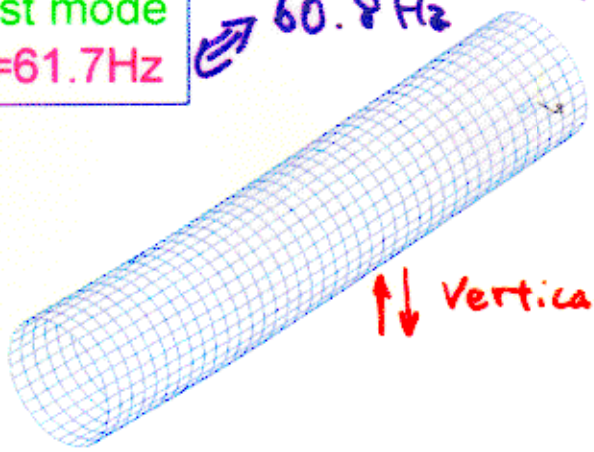
(1)-a Simply supported at both ends



(1)-b One end fixed.

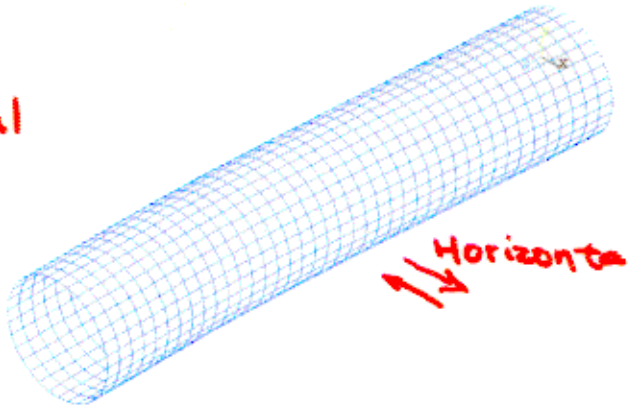
1st mode
f=61.7Hz

60.8 Hz (Theory)



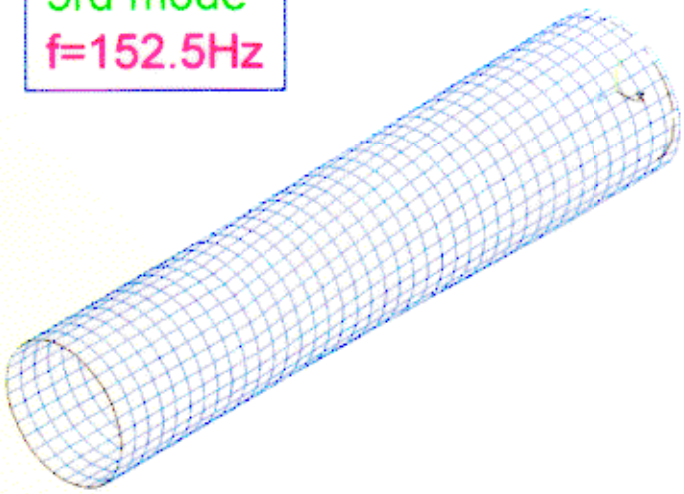
Vertical

2nd mode
f=61.8Hz

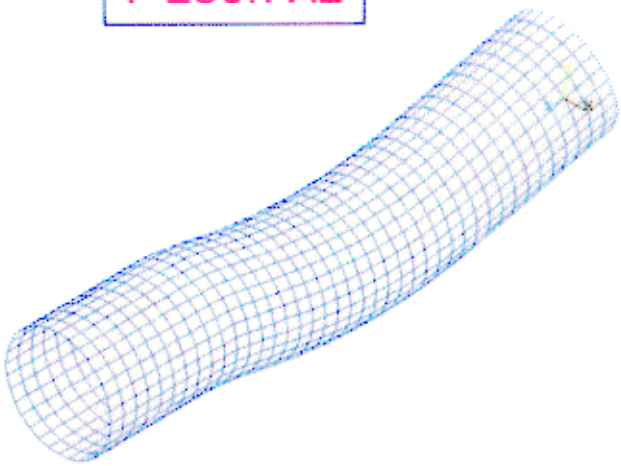


Horizontal

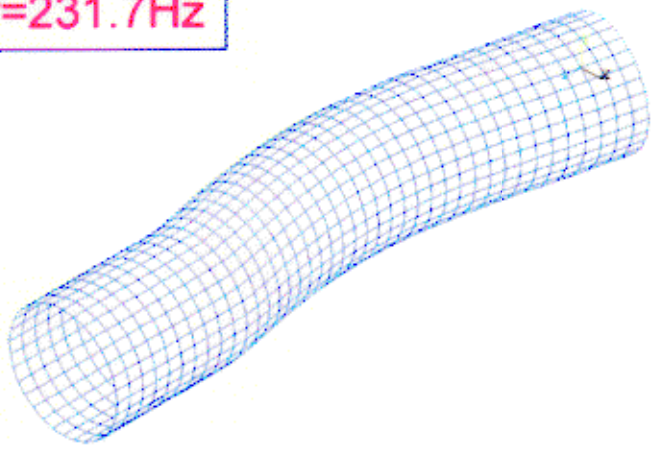
3rd mode
f=152.5Hz



4th mode
f=230.7Hz



5th mode
f=231.7Hz

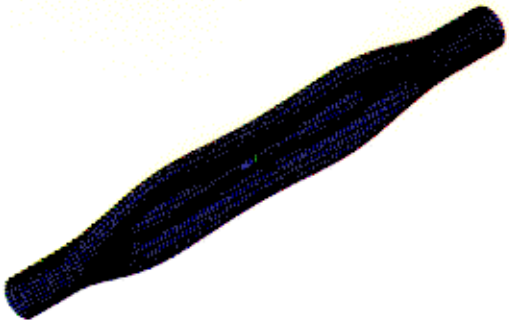


(2) In case of no rigid Tungsten mask

(1)-a Simply supported at both ends

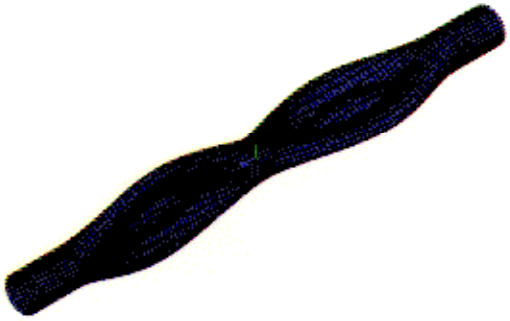
1st mode
f=11.1Hz

2nd mode
f=11.1Hz

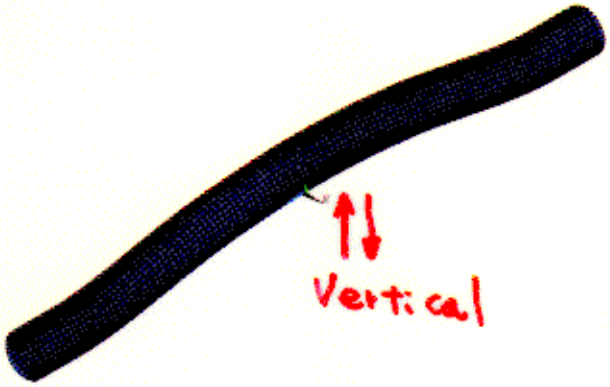


3rd mode
f=11.2Hz

4th mode
f=11.2Hz



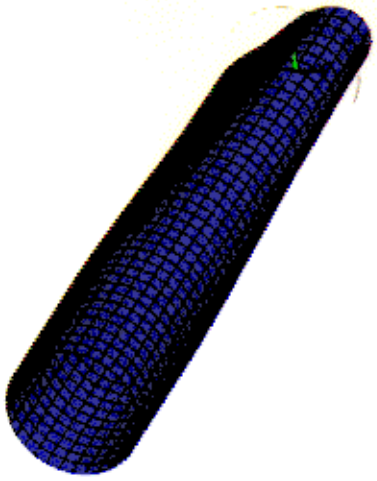
5th mode
f=15.6Hz



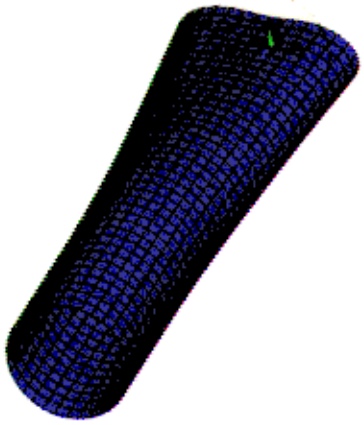
6th mode
f=15.6Hz

(2)-b One end fixed.

1st mode
f=7.2Hz

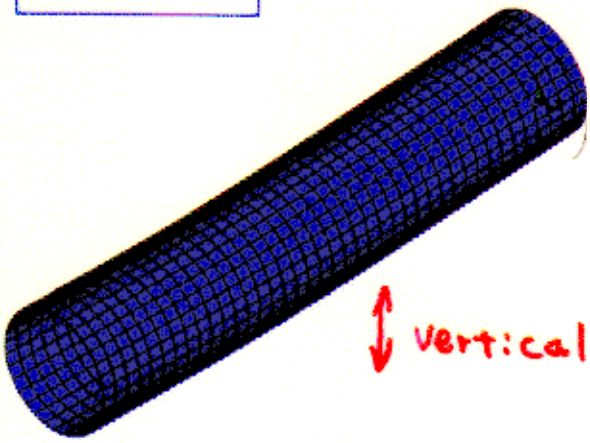


2nd mode
f=7.2Hz

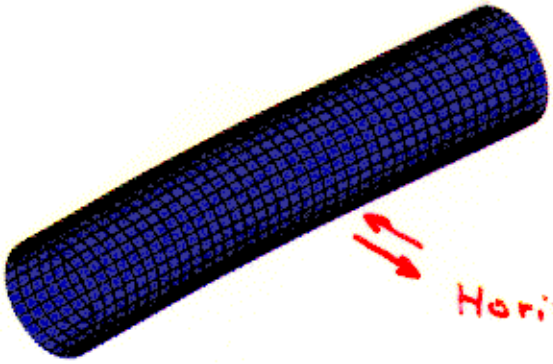


3rd mode
f=12.9Hz

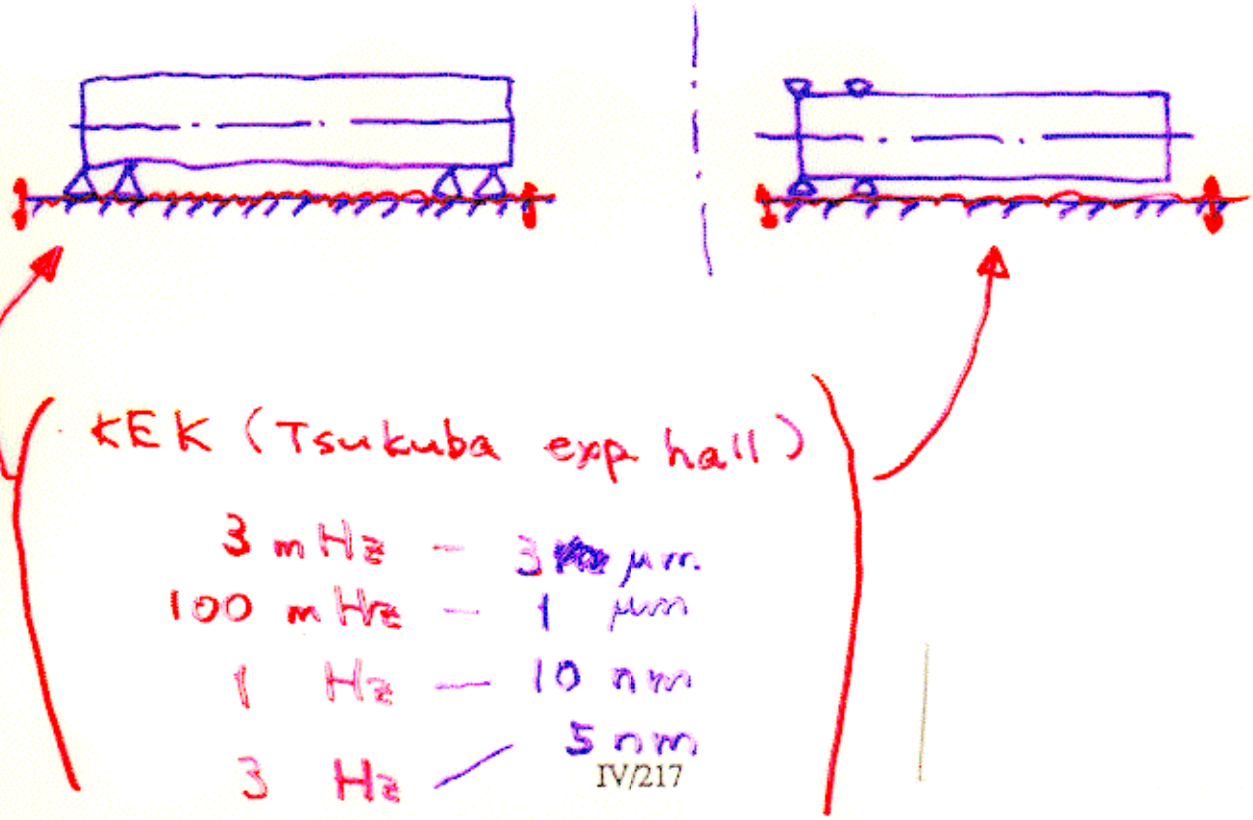
11.5 Hz (Theory)



4th mode
f=12.9Hz



4. Spectrum analysis.



(Reference)

MEASUREMENT OF THE SEISMIC MOTION AND THE DISPLACEMENT OF THE FLOOR IN THE TRISTAN RING

Ryuhei Sugahara, Kuninori Endo and Yasunobu Ohsawa
National Laboratory for High Energy Physics, Tsukuba-shi, Ibaraki-ken, Japan

1. INTRODUCTION

The design value for the beam size at the KEK B-factory is:

$\sigma_x = 140$ μm and $\sigma_y = 1.4$ μm [1].

Hereafter the coordinate system is defined as: X is the horizontal axis and Y the vertical axis in the plane perpendicular to the beam axis, and Z is along the beam axis. The beam collision is sensitive to the displacement of magnets located around the interaction point. For example, if the final quadrupole magnet moves vertically by 0.1 mm or more, the luminosity will drop noticeably. TRISTAN ring, electron-positron collider with diameter of 1 km, is planned to be modified as a B-factory.

The seismic motion and the displacement of the floor at TRISTAN ring were measured. Measurement was carried out in Fuji and Tsukuba interaction regions. At TRISTAN ring are located four experimental halls; two are big halls and other two are relatively small. Fuji and Tsukuba experimental halls are big ones having almost the same structure and located diagonally each other. In the B-factory project, the collision point is to be placed in Fuji experimental hall at present. The plan view of the experimental hall is shown in Fig.1. The floor in the experimental hall is 16.5 m deep and that in the accelerator straight section is 12.1 m deep from the ground surface. In the experimental hall, magnets are fixed on the movable base whose top surface is 5.7 m high above the concrete floor.

モーダル解析

レッスン B: 専門用語と概念

一般化運動方程式:

$$[M]\{\ddot{u}\}+[C]\{\dot{u}\}+[K]\{u\}=\{F(t)\}$$

M : Mass Matrix.

- 自由振動状態と減衰なしを仮定:

$$\Rightarrow [M]\{\ddot{u}\}+[K]\{u\}=\{0\}$$

ü : Acc. vector

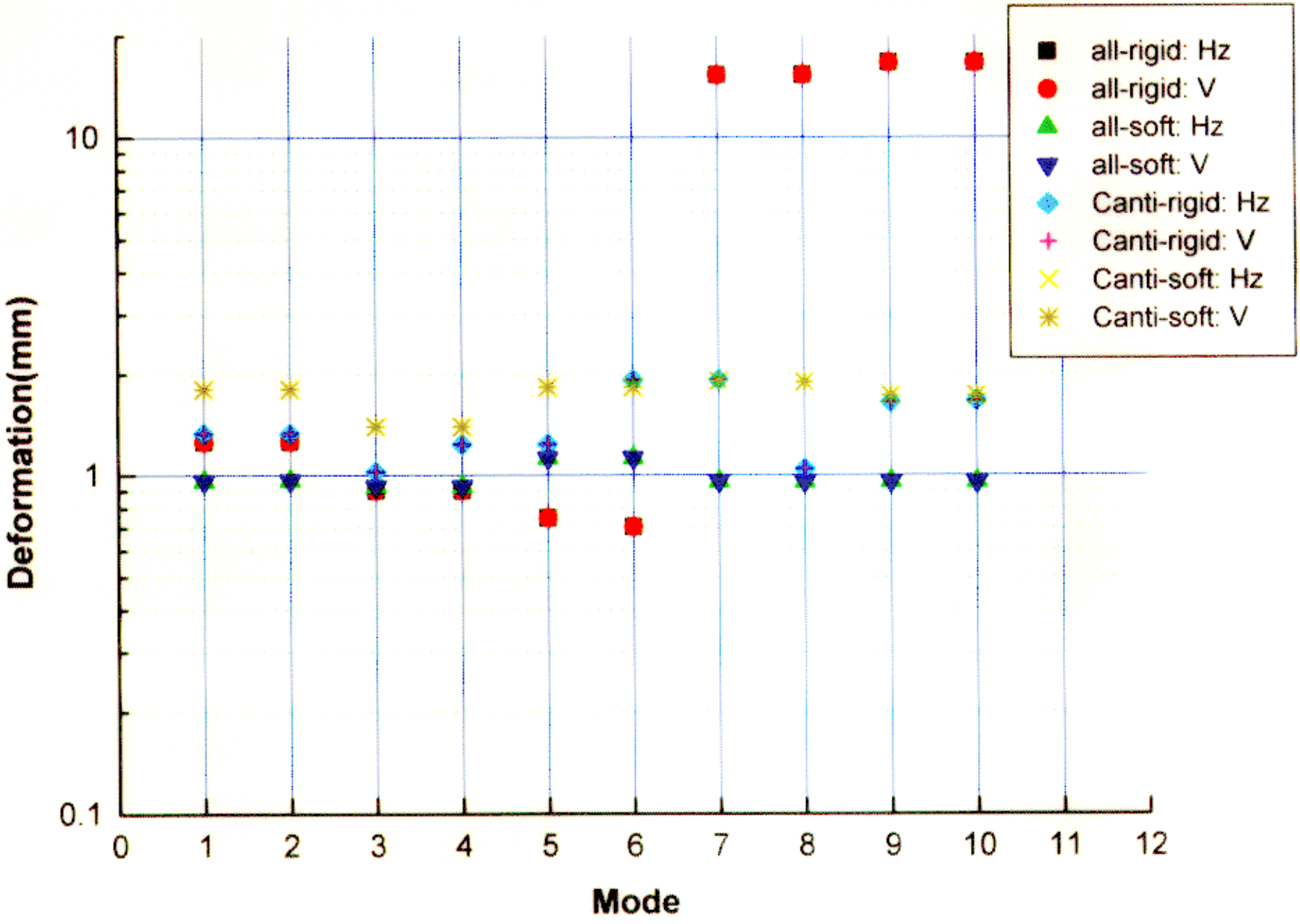
K : Stiffness Matrix

How much ?

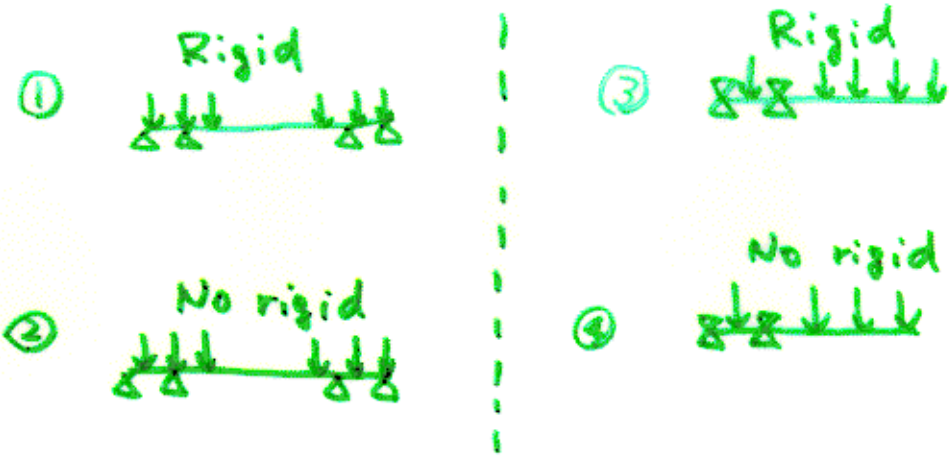
- 周期的運動を仮定:

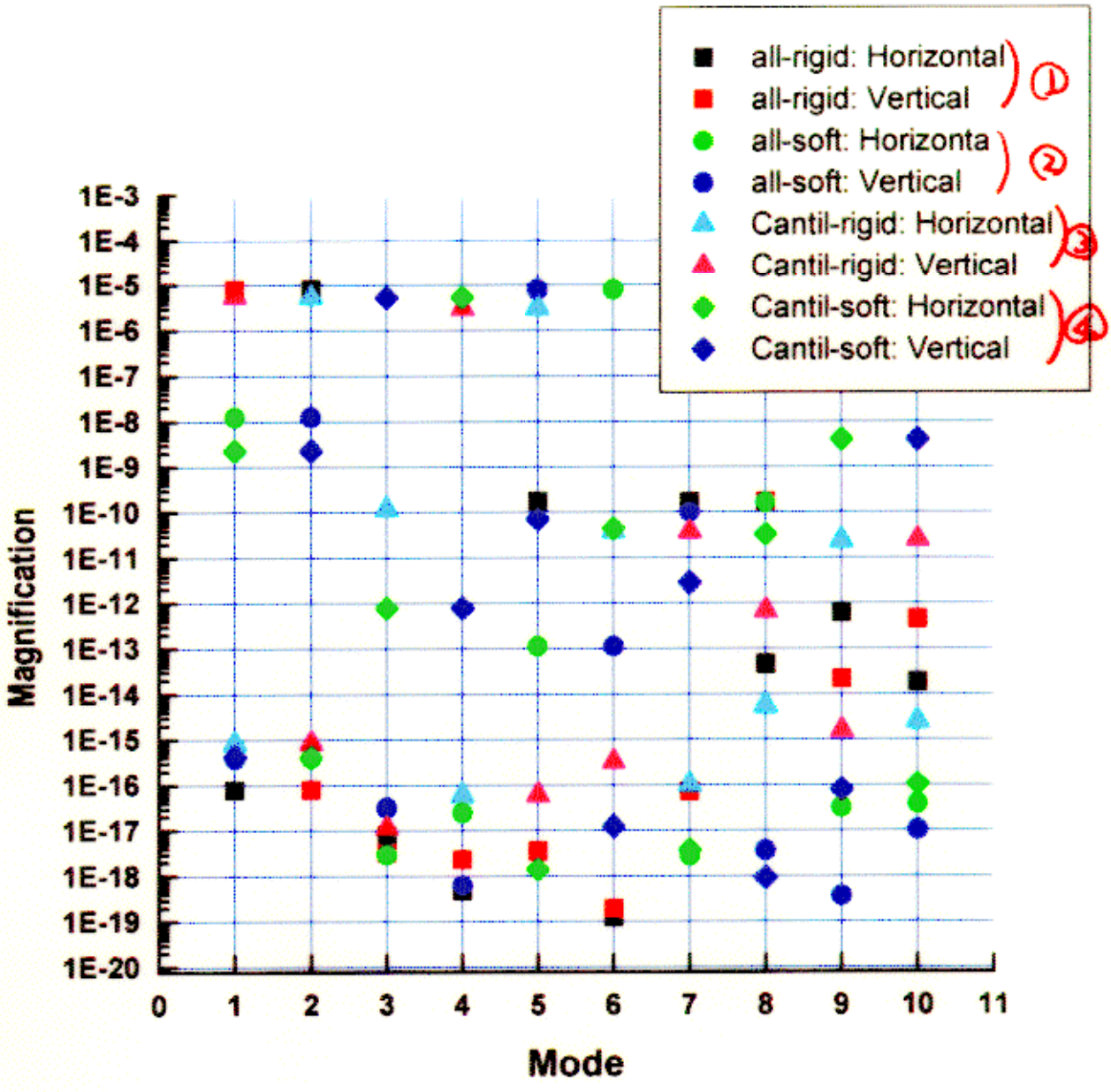
$$([K]-\omega^2[M])\{u\}=\{0\}$$

この方程式の根 ω_i^2 は*固有値を表し*、ここに i の範囲は1から自由度の数までである. 対応するベクトル $\{u\}_i$ は*固有ベクトル*である.


Deformation(mm)
10
1
0.1
0
1
2
3
4
5
6
7
8
9
10
11
12
Mode
all-rigid: Hz
all-rigid: V
all-soft: Hz
all-soft: V
Canti-rigid: Hz
Canti-rigid: V
Canti-soft: Hz
Canti-soft: V

(2) Magnification





(2) Deformation response