

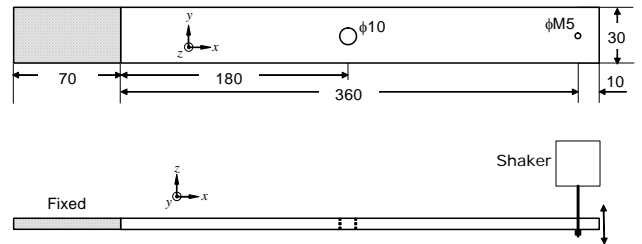
# Thermoelastic Stress Analysis of Cantilever under Cyclic Load

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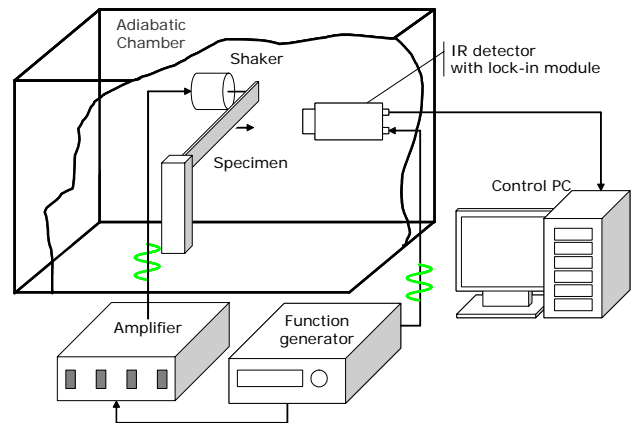
Key words : Thermoelastic stress, Thermography, Cyclic load, Cantilever, Material damping

Table 1 Comparison of measured roughness data

17.8 K <sup>-1</sup>	7900 kg/m <sup>3</sup>	500 J/kg-K	4.51 MPa <sup>-1</sup>
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(a) Geometry and boundary condition of specimen



(b) System configuration  
Fig. 2 Experimental setup

$$\rho c \frac{\partial T}{\partial t} = - \frac{E}{1-2\nu} \alpha T_a \frac{\partial \epsilon}{\partial t} \quad (1)$$

where  $\rho$  is the density,  $c$  is the specific heat,  $E$  is the Young's modulus,  $\nu$  is the Poisson's ratio,  $\alpha$  is the coefficient of thermal expansion,  $T_a$  is the ambient temperature, and  $\epsilon$  is the strain.

$$(T_a \gg T) \quad (1)$$

$$\Delta T = - \frac{\alpha}{\rho c} T_a \frac{E}{1-2\nu} \Delta \epsilon = - K_m T_a \Delta \sigma_{1,2,3} \quad (2)$$

### 3.

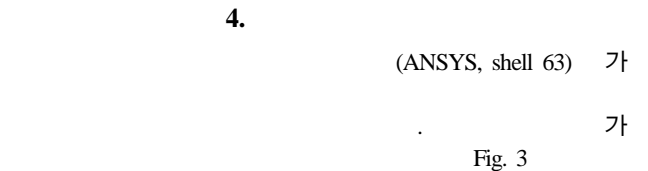
The specimen is modeled using Euler-Bernoulli beam theory.

STS304

Cedip Infrared System  
0.02 °C

Table 1

Fig. 1



(a) 2nd vibration mode (FEM: 37 Hz, Accelerometer: 35 Hz)

(b) 3rd vibration mode (FEM: 103 Hz, Accelerometer: 94 Hz)

Fig. 3 Vibration modal analysis

Fig. 3(a) 2, (b) 3 (nodal line) 가  
 Fig. 4 가, 3 (94 Hz) 가  
 35 Hz 가, 60, 70 Hz 가  
 "0" 가  
 Fig. 5 (40 Hz) 가  
 , Fig. 6 1 ~ 5 , 7  
 가 (Dynamic Stress Concentration Factor)

Table 2

1.6 ~ 1.7 가

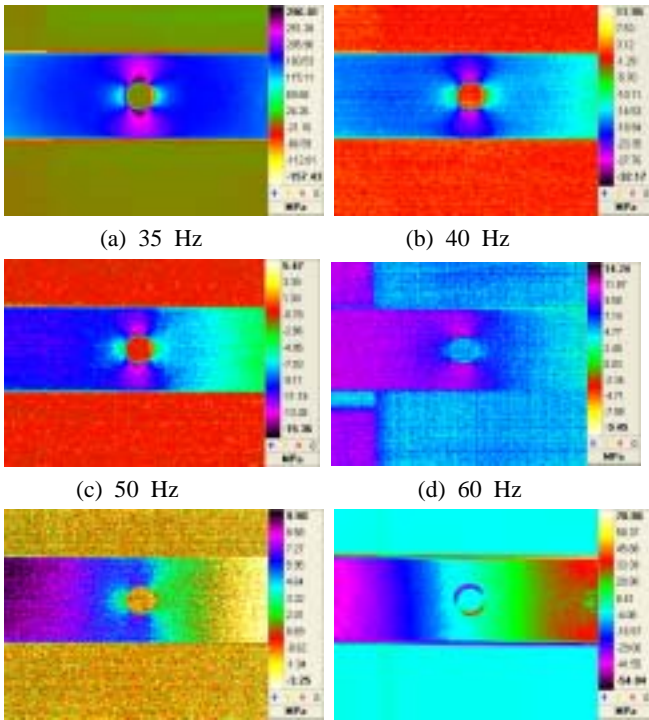


Fig. 4 Thermoelastic stress of each frequencies

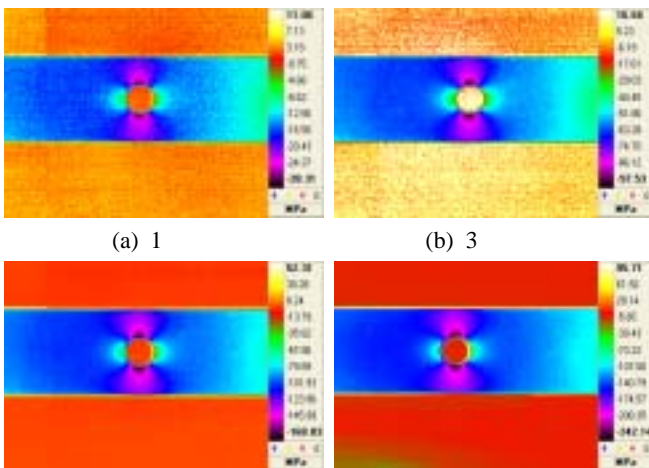


Fig. 5 Thermoelastic stress of each load

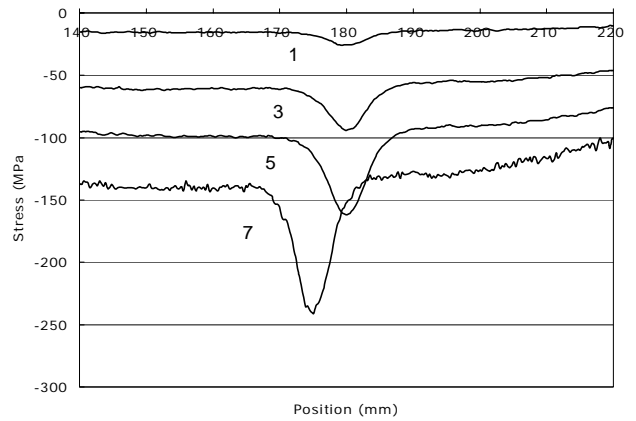


Fig. 6 Maximum stress nearby circular hole

Table 2 Dynamic Stress Concentration Factor of circular hole

	Max. stress	Avg. stress	SCF
1	25.8	15.5	1.7
3	94.3	60.6	1.6
5	161.7	98.6	1.6
7	240.8	139.6	1.7

5.

2 (35 Hz) 3  
 (94 Hz) 2 가

Euler-Bernoulli beam

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