

- (3) at $\omega = 259 \text{ rad/s}$ and $r = r_o$, $\sigma_\theta = \sigma_{\theta(\omega)} + \sigma_{\theta(\text{fit})} = 161 \text{ Mpa}$;
 $P_c = P_c^o + \sigma_{r(\omega)} = 89.3 \text{ MPa}$

1.5 THERMAL STRESS IN CYLINDERS AND DISKS

- **Disk (plane stress) (hollow or solid disk)**

$$\sigma_r = \frac{E}{1-\nu^2} \left[(1+\nu)C_1 - \frac{1-\nu}{r^2}C_2 \right] - \frac{\alpha E}{r^2} \int_b^r T_r dr$$

$$\sigma_\theta = \frac{E}{1-\nu^2} \left[(1+\nu)C_1 + \frac{1-\nu}{r^2}C_2 \right] + \frac{\alpha E}{r^2} \int_b^r T_r dr - \alpha ET$$

- **Cylinder (plane strain) (with or without central hole)**

$$\sigma_r = \frac{\alpha E}{(1-\nu)r^2} \left[\frac{r^2 - b^2}{a^2 - b^2} \int_b^a T_r dr - \int_b^r T_r dr \right]$$

$$\sigma_\theta = \frac{\alpha E}{(1-\nu)r^2} \left[\frac{r^2 + b^2}{a^2 - b^2} \int_b^a T_r dr + \int_b^r T_r dr - Tr^2 \right]$$

For a steady state of heat flow, we have

$$T = T_i + \frac{T_o - T_i}{\ln(a/b)} \ln \frac{r}{b}, T_i = T|_{r=b}, T_o = T|_{r=a}$$