

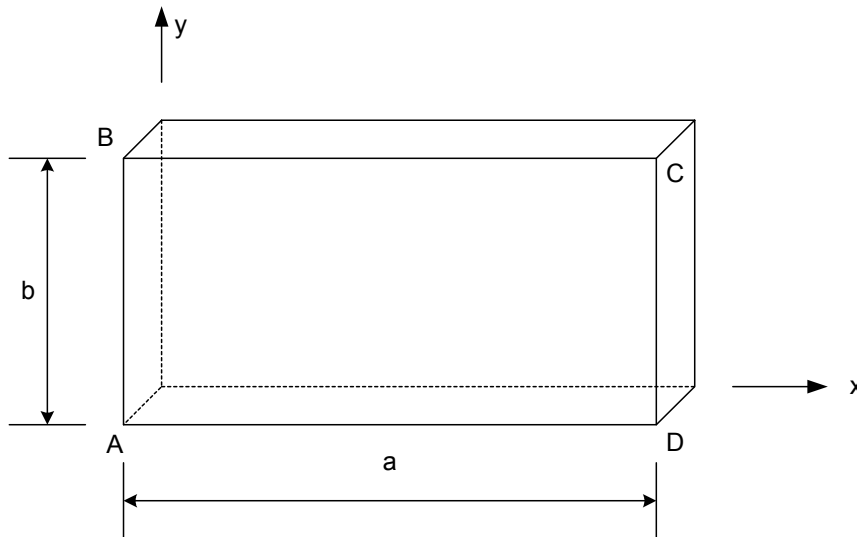
Midterm-Examination December 2002  
ME 215-683 Stresses in Plates and Shells  
By: Charoenyut Dechwayukul

Description: This exam consists of two parts. Both parts are mandatory. The time for each part is 1 hr. The first part is closed book. The second part is opened book. It is mandatory to do first part before. After student finished, the first part answer sheet should be submitted by each student at my office. The problem of second part will be available for each student after the first part is already submitted.

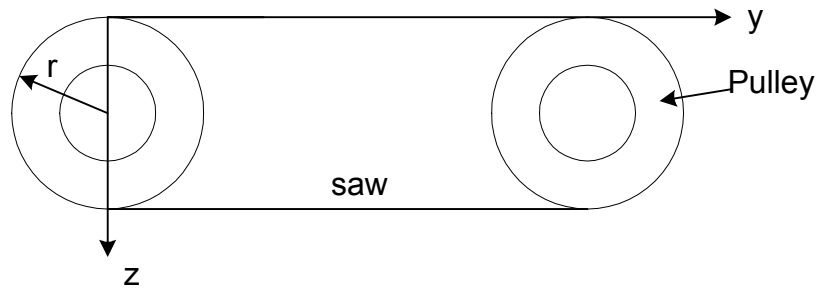
Problem (1-3, Closed Books and Notes, Time 1 hour)

1. A bronze rectangular plate ( $E= 100 \text{ GPa}$ ,  $\nu = 1/3$ ) is subjected to uniform stresses  $\sigma_x = 150 \text{ MPa}$  and  $\sigma_y = -90 \text{ MPa}$  along its edges as shown in figure. If it has a length  $a = 100 \text{ mm}$  width =  $50 \text{ mm}$ , and thickness =  $10 \text{ mm}$  prior to loading, after loading please calculate

- a) the dimensions  $a$ ,  $b$ , and  $t$
- b) the length of diagonal  $AC$

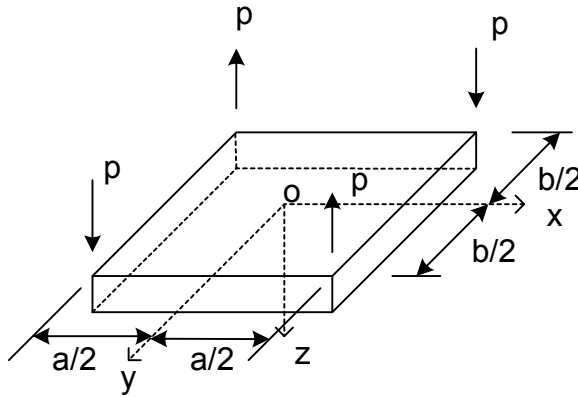


2. A 20-mm-wide and 0.5 mm-thick steel band saw ( $E=210$  GPa,  $\nu=0.3$ ) runs over two pulleys of 0.5 m diameter as shown in figure. Calculate the maximum bending strain and maximum bending stress in the saw as it goes over and confirms the radius  $r$  of a pulley.



3. A rectangular plate with free edges of length  $a$  and  $b$  and subjected to transverse corner forces of magnitude  $P$  as shown in the figure. Please answer the following questions.

- For solving of displacement of this plate, please identify the boundary conditions.
- Assume that the deflection function is  $W = C_1xy$ , please determine the constant  $C_1$



OPEN BOOK & OPEN NOTE (Time 1 hour)

4. The flat head of a piston is considered to be a clamped circular plate of radius  $a$ , the head is under a pressure  $p = p_o \left(\frac{r}{a}\right)^2$  where  $p_o$  is constant,  $r$  is radius and  $a$  is outer radius. Derive the equation of the head of a piston

