

Ae/AM/CE/ME 102c

Mechanics of Structures and Solids – Spring 2007-08

Assignment 2, Due April 17, 9:00AM, in class

Instructor: G. Ravichandran 109 Firestone ravi@caltech.edu x4525

Office Hours:

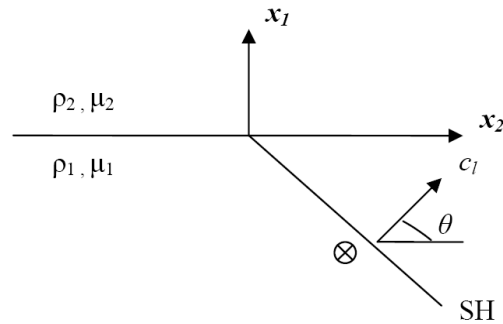
Michael Silva 204 Firestone michaels@caltech.edu Wed 1-3pm

Ling Zheng 212E Thomas lzheng@caltech.edu Mon 3-5pm

Grading TA: Michael Silva

Problem 1:

Consider a 2-D planar SH wave incident to an interface of two media as shown in the figure. Derive the expressions for the displacement and the stress components for the reflected and transmitted waves. Determine the displacement ratios of the amplitudes of the reflected wave and the transmitted wave to the amplitude of the incident wave.



Problem 2:

The bar shown below is initially at rest in an unstressed state, but in contact with a rigid wall as shown. The far end $\{x = 0\}$ is subjected to a velocity pulse

$$V(t) = V_0, \quad 0 < t < T$$

and is subsequently free (i.e., for $t > T$). Assume $V_0 > 0$. Analyze the behavior of the bar.

When does the bar first lose contact with the wall? Note: The rigid wall imposes the following conditions:

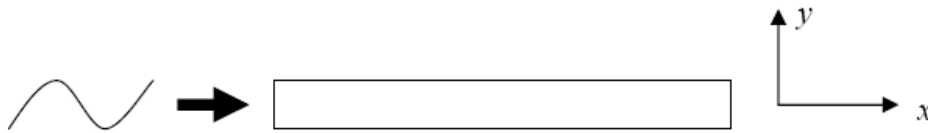
$$u(L, t) \leq 0$$

$$\sigma(L, t) \leq 0$$



Problem 3:

Consider wave propagation in a bar of length L in the x direction. (Poisson's ratio, $\nu=1/4$). In this problem we will consider transverse waves (particles are moving perpendicular to the direction of wave propagation). x is the direction of the wave propagation and y the direction of the transverse displacement.



- 1) Write the governing equation for the transverse displacement $u_t(x,t)$.
- 2) The solution of this equation is a right traveling wave of sinusoidal shape. Give a general expression for $u_t(x,t)$.
- 3) What is the velocity of transverse motion?
- 4) What is the shearing strain?
- 5) What can we conclude about the maximum distortion and maximum absolute value of the velocity?
- 6) Compute the kinetic energy of a small element of the bar.
- 7) Compute the strain energy of a small element of the bar.
- 8) Conclusion?