

**Homework 3 (revised)**

1. Show that the formula for linearizing a thermistor about a temperature  $T_m$  is given by:

$$R_p = R_{T_m} \frac{b - 2T_m}{b + 2T_m}$$

2. Consider the wave equation for a pressure wave:

$$\frac{\partial^2 p}{\partial x^2} - \frac{1}{c^2} \frac{\partial^2 p}{\partial t^2} = 0$$

- (a) Show that the following is a solution to the wave equation:

$$p(x, t) = Af\left(t + \frac{x}{c}\right) + Bg\left(t - \frac{x}{c}\right)$$

- (b) Show that the following is also a solution to the wave equation:

$$p(x, t) = A \cos(\Omega t + kx) + B \cos(\Omega t - kx)$$

where:

$$k = \frac{2\pi}{\lambda}$$

- (c) what is the relationship between the general solution in part (a) and the sinusoidal solution in part (b)?

(d) Show that under the scenario depicted on slide 108, assuming that the transducer boundary is a perfect reflector, if  $A = -B$ , a standing pressure (not displacement) wave is set up, with zero pressure on the transducer faces. What is the maximum positive pressure for the standing wave? where (at what value of  $x$ ) does it occur? at what times does it occur?

(e) How can the transducer faces undergo displacement when the pressure at  $x = 0$  and  $x = \lambda/2$  is zero?