AUBURN UNIVERSITY
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AEROSPACE

**AERO 4970/7970 Fundamentals of Aeroacoustics SET VI**
**Noise Control**

1. Consider a point source located a distance $h$ above a perfectly reflecting (infinite impedance) ground surface. If you locate an image source below the real source does this satisfy the boundary condition at the ground? Determine an equation for the acoustic pressure due to the direct waves and the reflected pressure.

2. A noise source produces sound mainly at 2500 Hz and an SPL of 95 dB at the location of a worker. In order to decrease this worker's noise exposure, the employer decides to build a brick wall ($\sigma$ = 400 kg/m$^2$) between source and worker. What would the sound level at the worker's location be after the wall is built. Assume that the wall is perfect and that the sound must go through it (not around it).

3. It appears that one way to control noise is to put a noise source in a room with massive walls to produce a high transmission loss. Think about this and answer the following:
   a) If a source generates W watts of acoustic power and the waves can propagate out spherically, what happens to the energy generated? What is the intensity on a sphere of radius $r$ encircling the source.
   b) What does steady state mean? It has the same meaning here as in fluid mechanics. Is the situation described above a steady state if we consider average intensity?
   c) What must happen to the energy if massive walls enclose the source? Saying "massive walls" means that the transmission loss through the walls is very large. What must happen if a steady state is reached in the room? Assume that all acoustic energy remains as acoustic energy, none is converted to heat, etc.

4. Water runs from a faucet into a barrel with a small orifice in its bottom.
   a) If the water in the barrel has constant depth $h$, what is the velocity of the water through the orifice? (Hint: This is a simple Bernoulli equation problem. Assume that the water in the barrel has negligible velocity at its surface.) What is the mass flow from the orifice? What is the mass flow from the faucet if the depth stays constant?
   b) What determines the mass flow out of the orifice? Examine your equation carefully.
   c) What happens if the flow rate from the faucet is increased? Must the flow rate from the faucet and from the orifice be equal at steady state? What must change to increase the flow out of the orifice?
   d) If instead of changing the flow from the faucet what would happen if the area of the orifice was reduced by half?