

ECE 473
Homework Assignment #10
Due: Friday, November 30, 2018

1. Problem 7.8.5 Kinsler et al.
2. An underwater linear array has 48 elements equally spaced at $d = 0.75\lambda$, where λ is the wavelength at its operating frequency. (a) Are there any grating lobes? If yes, determine the angular location of the first grating lobe. (b) What is the angular width (to the nulls) of the main lobe of the array? (c) If the main beam of the array is steered 60° off the array axis, then what is the angle of the grating lobe closest to the axis?
3. An baffled array consists of 5 elements that are piston sources of radius a . The pitch of the array is $d = 5/2a$. (a) Determine $H(\theta)$ for the array system. (b) If $a = \lambda$, determine the ratio of the mainlobe magnitude to the first grating lobe magnitude. (c) If the array is now steered to 45° , determine the ratio of the mainlobe magnitude to the grating lobe magnitude. (d) Discuss why the levels of the grating lobe and mainlobe are different in each case.
4. Problem 7.8.8 Kinsler et al.
5. Calculate the frequencies for the five lowest normal modes (eigenfrequencies) of a rigid-walled room of dimensions $L_x = 10$ m, $L_y = 5$ m and $L_z = 10$ m. The room is filled with air at 20°C .

Note to graduate students taking the course for 4 hours of graduate credit: For the additional credit, you are required to write a paper (typically about 10 pages, double spaced) that discusses in some detail any topic on acoustics for which the fundamentals of engineering acoustics are explicitly described. The paper is typically a summary of some acoustic topic and based on 4-5 peer-reviewed publications. The paper will be due **December 12, 2018**.