Room Acoustics – Homework 2

A rectangular control room for stereo music listening is considered, with the following dimensions (Length x Width x Height):

Group 1: 10m x 7m x 4m

Group 2: 9m x 6m x 3m

Group 3: 8m x 8m x 4m

Group 4: 8m x 7m x 3m

Group 5: 6m x 3m x 3m

Group 6: 4m x 4m x 2.5m

Group 7: 4m x 3m x 3m

Supposing that all walls are acoustically hard with negligible absorption, calculate the lowest 20 eigenfrequencies of the room.

The two loudspeakers (to be modelled as point monopoles) and the listener (a point receiver) are located at the vertices of an equilateral triangle with the length of the edges 2 m, which is parallel to the floor and at the height 1.5 m. The loudspeakers are placed at the distance 0.5 m from one of the two shorter walls of the room (or any of the four walls, if the given Length and Width are equal), symmetrically on the two sides of the vertical plane of symmetry of the room. Reverberation time of the room is 2 s in the entire frequency range of interest.

Calculate the room frequency response for the two loudspeakers (separately) at the listener's location using your own code. Choose an appropriate frequency range and the number of modes[1].

Test two additional sets of loudspeakers' and listener's locations in the room (still placed at the vertices of an equilateral triangle with the edge 2 m, parallel to the floor, and at the height in the range between 1.1 m and 1.7 m). In at least one configuration the listener should be displaced from any of the room's three planes of symmetry parallel to the walls and floor.

Repeat the calculations from above for the reverberation time 0.3 s.

Comment the obtained results with regard to the purpose of the room.

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[1]Note that the analytical solution for a rectangular room should be used, so many modes at frequencies well above the Schroeder frequency can be included.