Course title: Fundamentals of Acoustics and Noise Control Course number: 34840

Individual hand-in problems – deadline 14-10-2022.

Your solution should include justification for the methods used, including assumptions and simplifications. Comment on the results where relevant.

Problem 1:

A porous material made out of leftover PTFE fibres is tested for use as an absorber.

The test specimen is placed at the end of a tube and a loudspeaker is attached at the other end, driving the sound field inside the tube at a single low frequency, where only plane waves can exist.

The sound pressure level inside the tube is measured with a moveable microphone and the sound pressure level at the positions with minimum and maximum sound pressure are measured to 62.7 dB SPL and 90.6 SPL dB respectively.

Q1.1: Calculate the following quantities: Minimum and maximum sound pressure amplitude inside the tube, standing wave ratio and absorption coefficient of the test absorber.

In the following it can be assumed that the surface impedance of the absorber, i.e. the ratio between sound pressure and particle velocity, is real valued.

Q1.2: Calculate the surface impedance of the absorber and interpret the result. If you obtain several values for the solution then evaluate which one is the most realistic. If the absorption coefficient was not obtained from Q1.1 use the value of 0.2.

Problem 2:

A pulsating sphere is radiating in free field at a frequency of 250 Hz. At 10 meters distance the sound pressure level has been measured to 72.2 dB SPL.

Q2.1 Calculate the total acoustic power radiated by the source.

The driving frequency is now changed to the (much lower) value of 20 Hz. At this frequency the source is known to produce less output than at 250 Hz.

At a distance of 2 meters the particle velocity amplitude has been measured to 1.5 mm/s.

Q2.2: Calculate the (radial) intensity at a distance of 2 m, and the total acoustic power from the source.