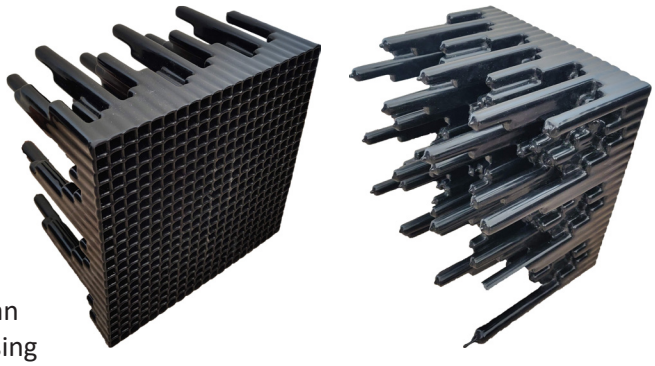
Public summary



The sound-absorbing panel shown in the figures on the right has been developed by Ysbrand Wijnant at the Structural Dynamics and Acoustics group of the University of Twente. The panel absorbs sound by means of quarter-wavelength resonators (air-cavities for which the length equals a quarter of the wavelength to be absorbed). The main objective is to find an application for this panel and to make it an aesthetically pleasing product.

The client's, Ysbrand Wijnant, expertise is acoustics, sound fields, technical mechanics and engineering fluid dynamics. The objective the client is aiming for is to find possible applications for the sound-absorbing panel and make it a product that is easy to manufacture, aesthetically pleasing and as sustainable as possible. Questions that arose for development are: What will the design look like? Is this a commercially interesting product? What are the advantages and disadvantages in comparison to products that are already on the market? What could be interesting applications? Which frequencies do you want to mute? What material could it be made of? How will it be put on the market? So, the overall objective is to develop this working concept, a wall with holes, into a (consumer)product.

This thesis consists of two parts, in the first part the process of finding an application for the panel is described and it is explained how the panel absorbs sound. In the second part, after the application (a room divider for offices) was chosen, the designing process of the sound-absorbing room divider is described.

Based on desk research and the objective of the client, the main project aim is described as:

Development of a sound-absorbing room divider for offices, by rectangular and triangular sound-absorbing blocks using quarter-wavelength resonators.

To achieve this main project aim, research questions and sub-questions should be answered.

In the first part of the thesis, the following sub-questions were answered:

Finding the possible applications for the panel

I. What are the environments with noise pollution which could benefit from such a product?
II. What sound-absorbing products are already on the Dutch market?
   a. What is their application/price/design?
   b. What material is it made of?
   c. How are they manufactured?
   d. How do they absorb sounds and for what frequencies?
   e. What products make use of quarter-wavelength resonance?
III. How does the panel absorb sounds?
   a. What is sound absorption and how is it measured?
   b. How does a quarter-wavelength resonator work?
   c. How does the shape of the panel affect the absorption coefficient?
   d. What area should be covered with the sound absorbing product?
IV. What are the advantages and disadvantages of this sound-absorbing panel in comparison to products that are already on the market?
   a. What are the markets/applications that still ask for solving acoustic problems?

When the specific application, a room divider, was chosen, the design phase could start and the following sub-questions were answered:

Development of the sound-absorbing room divider

I. What sound-absorbing and non-sound-absorbing room dividers are on the market?
   a. What size, shape, material and price?
II. What frequency range should the room divider absorb?
   a. What frequencies cause noise pollution at offices?
   b. What is a convenient length for the resonators?
III. What should the design of the absorber look like?
   a. What size, colour, shape, material?
   b. How can it be assembled?
IV. What should the design of the frame look like?
   a. What size, colour, shape, material?
V. How can the room divider be manufactured?
   a. How much material is needed?
   b. What production technique?
   c. What will be the price?

After doing thorough research, using the quarter-wavelength sound-absorbing panel for a premium room divider proved to be a fitting consumer application. The end products are a well-thought-out square and triangular sound-absorbing block with quarter-wavelength resonators on the front and rear side and a suggestion for a modular frame design to hold the sound-absorbing blocks. The combination creates a room divider that can be used in daily practice, e.g. in offices. The room divider is visualized with design sketches and renders of a 3D model in SolidWorks. A plexiglass prototype is made of the absorber, to show the functionality and looks. Also, a hearing test and calculations on the absorption coefficient of the absorber and on tipping forces on the room divider are executed. A suggestion for production and a rough cost estimate are given. Furthermore, recommendations for further development are given.