Vibroacoustic metamaterials for broadband sound insulation in building acoustics

A Data Management Plan created using DMPonline.be

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Project abstract:

Noise coming from traffic, industrial and construction activities or neighbors has a severe impact on people and results in activity disturbance, social tensions and health problems. It is therefore of paramount importance to ensure sufficient levels of sound insulation. This is very challenging, especially for emerging sustainable types of construction such as cross laminated timber (CLT). Recently, a very promising sound insulation concept has been developed. It consists of adding small, local resonators to a host structure so as to create a vibroacoustic metamaterial with superior sound insulation properties. However, conventional vibroacoustic metamaterials target only bending waves in thin panels. In this postdoctoral research project, vibroacoustic metamaterials will be developed to achieve broadband sound insulation in building acoustics for the first time, by targeting simultaneously several wave types in thick walls and floors. This key open challenge will be tackled by first developing analytical and numerical vibroacoustic models to analyze the interaction between the metamaterial resonators and the different target wave types. Subsequently, a methodology for the resonator design will be established to maximize sound insulation under the appropriate practical constraints. Finally, the potential of both fundamental developments will be demonstrated through the design of novel building elements in CLT and hollow masonry with superior sound insulation properties.

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1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Matlab files	Scripts for numerical simulations and optimization, saved input data, and output results	Generate new data	Digital	Software, simulation data	.m, .mat	<1 TB	
Comsol files	Scripts for simulation, input data, and saved results	Generate new data	Digital	Software, simulation data	.mph, .mphbin, .mphtxt, .mphphb	<1 TB	
Experimental data	Acquisition scripts, acquired data from vibration and sound insulation testing	Generate new data	Digital	Software, experimental	.csv, .vi, .tdms, .ana, .bid,	<1 TB	
Demonstrators	Metamaterial resonators, building components	Generate new data	Physical				Resonators (10-100), 1 metamaterial plasterboard panel, 1 metamaterial CLT floor, 1 metamaterial hollow brick wall.
BWM toolboxes	Matlab toolbox for numerical simulation, available at the Structural Mechanics Section	Reusing existing data		Software	.m	<100 GB	

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

BWM toolboxes: toolboxes of the Structural Mechanics Section for numerical simulation, developed during several years of research and available to all members of the Section on shared drives. This project will make particular use of the tools developed within the ERC Starting Grant 714591 VirBAcous.

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- Yes

The developed computational tools and designs are primarily tailored towards academic purposes. Nevertheless, the potential for commercial valorization will be carefully checked with KU Leuven IP guidance and LRD, before publication.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

All digital data are stored in chronological order on KU Leuven OneDrive and HDDs for backup purposes. A clear explanation of the contents is provided in accompanying readme.txt files included in the same folders. Relevant commenting is included in Matlab/Comsol scripts so that they can be reused in the future.
The most relevant Matlab scripts (.m) will be included in the BWM toolboxes, to further facilitate their use for future research within the Structural Mechanics Section.

Detailed reports will be generated regarding the realization and test of each physical demonstrator, to facilitate the replication of prototypes and experiments in the future.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

3. Data storage & back-up during the research project

Where will the data be stored?

Digital data will be stored on KU Leuven OneDrive, KU Leuven shared network drives and external HDD drives.
Physical prototypes will be stored at the KU Leuven Laboratory of Acoustics.

How will the data be backed up?

For digital data, standard backup provided by KU Leuven OneDrive and by KU Leuven ICTS on shared network drives will be used. This solution guarantees security and version control of the data. In addition, external HDD drives will be used.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The access to KU Leuven OneDrive and shared network drives is secured by KU Leuven authentication. External HDD drives will be stored in secure places (closets, drawers) and locked.
The KU Leuven Laboratory of Acoustics, where physical prototypes will be stored, requires badge access. Furthermore, the prototypes will be stored in secured and locked spaces.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

Costs are related only to external HDD drives, as the available free space provided by KU Leuven on OneDrive and Teams-site is sufficient. HDD costs are about 100 euros per disk and no more than 2 disks will be required. Such costs will be covered by my FWO bench fee.
No specific costs are foreseen for the storage of the physical prototypes in the KU Leuven Laboratory of Acoustics.

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All digital data can be preserved after the end of the project and for at least 10 years both online (KU Leuven One Drive and KU Leuven shared network drives), as well as on HDDs.
Physical prototypes can be preserved in the KU Leuven Laboratory of Acoustics for at least 1 year. Preservation for up to 5 years will be evaluated based on the storage capacity of the laboratory. If this is not possible, as a backup plan, detailed drawings, reports and instructions will be preserved as digital data, to allow for the replication of the prototypes.
Prof. Edwin Reynders will have access to all generated data also after the project.

Where will these data be archived (stored and curated for the long-term)?

Digital data will be archived on KU Leuven shared network drives and on external HDDs as backup. Physical prototypes will be stored in the KU Leuven Laboratory of Acoustics.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

Datasets will be of a limited size that can be stored with no cost (<5 TB). No cost is foreseen for the storage of physical prototypes.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in a restricted access repository (after approval, institutional access only, …)

The datasets might be used for research collaboration purposes with other researchers during the project. The most relevant datasets will be available for further research activities within the Structural Mechanics Section after the project ends.

If access is restricted, please specify who will be able to access the data and under what conditions.

Prof. Edwin Reynders will have access to all datasets after the project. The most relevant datasets will be made available for all members of the Structural Mechanics Section.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

NA

When will the data be made available?

After publication and upon request and agreement with research collaborators.

Which data usage licenses are you going to provide? If none, please explain why.

This is not clear yet. Will be decided if necessary during the project.

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- No

What are the expected costs for data sharing? How will these costs be covered?

No cost is expected.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Daniele Giannini

Who will manage data storage and backup during the research project?

Daniele Giannini

Who will manage data preservation and sharing?

Daniele Giannini

Who will update and implement this DMP?

Daniele Giannini