
Towards multi-functional behavior of metal lattice structures produced by hybrid laser based additive and subtractive manufacturing techniques

A Data Management Plan created using DMPonline.be

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Project abstract:

Additive Manufacturing (AM) has significantly increased the potential of metal lattice structures (MLS). For structural applications, first steps are being made to investigate the use of AM-MLS for weight reduction, and for improving and tuning mechanical characteristics such as stiffness, energy absorption, impact resistance, damping or fatigue performance. Multi-functional MLS designed to perform well in several of these areas are at present, however, not available. Also the complex relationships between manufacturing process, unit cell design, parent material, operational loading and dynamic behavior of such lattice structures are not yet well understood. This research project aims at addressing this by unraveling the fundamental features that influence the dynamic behavior of MLS. Unique inhouse developed hybrid laser based additive/subtractive manufacturing techniques will be tailored for manufacturing of metal lattice structures with improved and tunable surface characteristics aiming at enhanced impact, fatigue and dynamic material properties. At the same time, the influence of unit cell design, material and operational dynamic loading will be analyzed in detail using multiscale simulations. Input for the simulations and validation cases will be provided by purpose-developed static, fatigue and high strain rate experiments covering material length scales from the lattice struts over, one or multiple, unit cells to solid structural components.

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Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects ...) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

The project will generate new data and samples including:

- 1) Data on finite element modeling and other numerical simulations
- 2) Raw measurements of the manufactured parts
- 3) Digital files of the geometry of the manufactured parts
- 4) Manufactured academic demonstrator parts
- 5) Experimental test data
- 6) Published data (publications, public videos, presentations, research reports, etc.)

Total data volume is estimated to be <1000 GB for the whole project

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

1. *Designated responsible for data management: Prof. Brecht Van Hooreweder*

During research

The data will be stored on the university's central servers with automatic daily back-up procedures. For daily use the shared Box account has a capacity of 100 Gb. For larger data sets (especially videos and experimental test data) extra capacity will be hired (<100 EUR/year booked as a consumable).

After research

The data & metadata, together with the documentation will be preserved on the university's central storage for archiving data for 5 years. As the dataset for this project is limited, the costs for archiving research data are centrally covered by the departments involved

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

NO

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

NO

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

The researchers working on this project under supervision of the PI are responsible for the DMP. After the end of the project, the ICT service of the department will assist in archiving all data. For the 5 years after the project, the PI will be the main contact for requesting access to the data.

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FWO DMP (Flemish Standard DMP)

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
		<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Generate new data Reuse existing data 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Digital Physical 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> Observational Experimental Compiled/aggregated data Simulation data Software Other NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> .por, .xml, .tab, .csv, .pdf, .txt, .rtf, .dwg, .gml, ... NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> <100MB <1GB <100GB <1TB <5TB <10TB <50TB >50TB NA 	
Test samples	samples in different metals produced by LPBF	N	P	Samples	NA		10-500 samples (<0.5m³)
Demonstrators	in titanium	N	P	Demonstrators	NA	NA	5 parts (>0.5m³)
Fatigue and high speed impact test data	results from experimental testing	N	D	N	.csv, .tct, .docs, .m	<1GB	
Images and videos	From the process, from sample testing and from DIC	N	D	N	.mp4	<5GB	
Metadata describing the setup and procedures		N	D	N	.docs, .txt	<3Gb	

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:

NA

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

NA

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

NA

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 manufacturing methods and the simulation tools that will be developed and that will be described in the MetaData mentioned above will be considered as confidential and could lead to patent filings.

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.

- Yes

This is an FWO project with KU Leuven (lead) and UGent. A standard agreement between both universities was setup and signed in June 2023.

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).

test samples: will be named and labelled and stored in dedicated sample boxes that the AM teams have been using regularly. Samples boxes will be stored in a closet dedicated to this project.

demonstrators: will be labelled and foreseen by a short text

Properties of parts; Mechanical fatigue data and impact data; Images and videos and Metadata describing the setup and procedures will be stored in separate folders with "readme.txt" explanation of folder structure, on the OneDrive folder that the consortium has made specifically for this project to collaborate. After the project end date, this data will be transferred to the KU Leuven K: drive (archive) with automatic backup.

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?

OneDrive (KU Leuven) + KU Leuven K drive after end of project (backup/archive)

How will the data be backed up?

Standard back-up provided by KU Leuven ICTS for my storage solution

Personal back-ups I make which is on the AM team offline backup NAS (once every 2 months)

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?

On the one hand, in this project no sensitive personal data will be used. On the other hand, both cloud and ICTS based storage solutions are only accessible via proper credentials which are centrally managed. Hence, unauthorized access via legal means is not possible

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

none

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 data will be preserved for 10 years according to KU Leuven RDM policy

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

KU Leuven K; drive

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

None

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.

Question not answered.

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

All data will be shared openly within KU Leuven using the onedrive folder. External parties (e.g. companies) can only access the data after approval by the consortium and e.g. after setting up an NDA if required.

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.

- Yes, Intellectual Property Rights

Any of the mentioned datatypes could disclose confidential information on the KU Leuven research, for instance methods that could be patented, and hence this will be checked with the KU Leuven consortium before making datasets publicly available. In reality, it is expected that only a small amount of data will be considered confidential and not-publicly accessible.

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

KU Leuven RDR (Research Data Repository)

When will the data be made available?

Upon publication of research results

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

CC-BY 4.0 (data)

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.

- Yes

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

Possible costs linked to open repositories and costs related to preparing data and uploading it will be covered by the project budget

6. Responsibilities

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

The main PI, Brecht Van Hooreweder

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

All researchers involved.

Who will manage data preservation and sharing?

The main PI, Brecht Van Hooreweder

Who will update and implement this DMP?

The main PI, Brecht Van Hooreweder

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GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

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DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable