
Characterizing, Prediction and Improvement of Fretting Fatigue in Additively Manufactured Parts Produced by Laser Powder Bed Fusion

A Data Management Plan created using DMPonline.be

Creator: Reza Talemi

Affiliation: KU Leuven (KUL)

Funder: KU Leuven (KUL)

Template: KU Leuven BOF-IOF

Principal Investigator: Reza Talemi

Data Manager: Reza Talemi

Project Administrator: Reza Talemi

ID: 203746

Start date: 01-10-2023

End date: 30-09-2025

Project abstract:

Successful construction of metallic components for safety-critical applications using Additive Manufacturing (AM) - such as Laser Powder Bed Fusion (LPBF) technique - requires a thorough understanding of the associated mechanical properties, especially fatigue resistance. Among different fatigue failure modes, fretting fatigue is a very complex phenomenon which occurs at micro-sliding contacts while subjected to external cyclic loadings. Fretting fatigue failure occurs in many applications such as bolted and riveted connections, steel cables, bearings shafts, dovetail joints in rotating disc and blades, shrink-fitted connections in railway wheelsets and gear shaft assemblies. Research works focusing on tribo-mechanical properties of LPBF-AM parts is scarce. In particular the fretting fatigue response of LPBF-AM parts is entirely an open question. Therefore, the impact of fretting on the fatigue response of AM-LPBF components merits in-depth investigation to push the boundaries of the current-state-of-the art. The pivotal points of this research proposal are characterizing, predicting and improving the fretting fatigue response of LPBF-AM parts. To this end, in the first place, this research work focuses on characterizing fretting fatigue behaviour of the LPBF-AM material experimentally to reveal influences of different printing parameters, microstructural features, internal porosities/defects and post heat treatment processes on the lifetime of LPBF-AM parts. Advanced numerical models will be developed for a comprehensive and quantitative characterization of the microstructural features of the LPBF-AM material and further development of the statistical synthetic microstructure model generation platform for fine tuning of the microstructure features. Eventually, a unique in-situ laser re-melting technique is explored to prolong lifetime of LPBF-AM parts when subjected to fretting fatigue loading conditions.

Last modified: 19-12-2023

Characterizing, Prediction and Improvement of Fretting Fatigue in Additively Manufactured Parts Produced by Laser Powder Bed Fusion

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.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		<i>Indicate: N(ew data) or E(xisting data)</i>	<i>Indicate: D(igital) or P(hysical)</i>	<i>Indicate: Audiovisual Images Sound Numerical Textual Model SOftware Other (specify)</i>		<i>Indicate: <1GB <100GB <1TB <5TB >5TB NA</i>	
Test samples	Samples which will be used for experimental testing	N	P	N	Excle and word files	<1GB	NA
Finite Element Simulation	Numerical simulations	N & E	D	N, I, SO	Abaqus files	<1TB	NA

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:

In this project the Finite Element Models that have been developed in previous research works which has been saved in an external hard drive will be used.

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- No

Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- 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.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or 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

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 data generated in this project will be stored in formats such as Excel, Word, PowerPoint, and Abaqus simulation software. To enhance the clarity of the generated data, README.txt files are employed to provide descriptions for each of these files

Will a metadata standard be used to make it easier to find and reuse the data?

If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- No

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Personal network drive (I-drive)
- Shared network drive (J-drive)
- OneDrive (KU Leuven)
- Sharepoint online

External hard drives.

How will the data be backed up?

- Personal back-ups I make (specify below)
- Standard back-up provided by KU Leuven ICTS for my storage solution

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, 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?

Access to the shared data will be restricted to authorized personnel for a limited duration. Additionally, external hard drives will only be accessible to authorized individuals

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

We anticipate no additional costs for this project, as the repository is already available and will be utilized for storing generated data.

Data Preservation after the end of the Research Project

Which data will be retained for 10 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)?

- Shared network drive (J-drive)
- KU Leuven RDR

External hard drives.

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

NA

Data Sharing and Reuse

Will the data (or part of the data) be made available for reuse after/during the project?

Please explain per dataset or data type which data will be made available.

- Yes, as open data

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

NA

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 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.

- KU Leuven RDR (Research Data Repository)
- Other data repository (specify below)

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 persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- No

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

NA

Responsibilities

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

The Project PI (Reza Talemi) will manage data documentation and metadata during the research project.

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

The Project PI (Reza Talemi) will manage data documentation and metadata during the research project.

Who will manage data preservation and sharing?

The Project PI (Reza Talemi) will manage data documentation and metadata during the research project.

Who will update and implement this DMP?

The Project PI (Reza Talemi) will manage data documentation and metadata during the research project.