
Plan Overview

A Data Management Plan created using DMPOnline.be

Title: AI-based automated design for reliability of grid-connected PV inverters

Creator: Adamou Moussa Issaka

Principal Investigator: Wilmar Martinez Martinez, n.n.

Data Manager: Adamou Moussa Issaka, Wilmar Martinez Martinez

Project Administrator: Wilmar Martinez Martinez

Affiliation: KU Leuven (KUL)

Template: KU Leuven BOF-IOF

Principal Investigator: Wilmar Martinez Martinez, n.n. n.n.

Data Manager: Adamou Moussa Issaka, Wilmar Martinez Martinez

Project abstract:

This research focuses on enhancing the reliability of grid-connected photovoltaic (PV) inverters by developing a novel **capacitorless inverter topology** and an AI-based control strategy. Traditional PV inverters rely on electrolytic capacitors, which are prone to failure and significantly impact system lifespan. The proposed approach eliminates these capacitors, thereby improving durability, reducing maintenance costs, and enhancing overall system efficiency. To achieve this, the project explores advanced control techniques using **artificial intelligence (AI)** to compensate for the absence of capacitors while ensuring stable grid synchronization and high power quality. The AI-based control strategy will optimize voltage regulation, mitigate power fluctuations, and enhance fault tolerance.

The research methodology includes extensive MATLAB/Simulink simulations and real-time hardware validation. By addressing key reliability challenges, this project contributes to the development of **longer-lasting, more efficient, and cost-effective** PV inverters for sustainable energy systems, supporting the future of smart grids and renewable energy integration.

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AI-based automated design for reliability of grid-connected PV inverters

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>	Indicate: A udiovisual I images S ound N umerical T extual M odel S oftware O ther (specify)		Indicate: <1GB <100GB <1TB <5TB >5TB NA	
Clim_Data	Climate data such as solar irradiance and ambient temperature	E	D	N	*.xlsx	<1GB	
Simul_Data_Gen	Inverter simulation data generation, input & output voltages and currents, dc-link capacitance values, load variations, junction temperature of capacitors, ripple current	N	D	N	*.csv	<1GB	
Exp_Data_Gen	Inverter experimental data generation, input & output voltages and currents, dc-link capacitance values, load variations, junction temperature of capacitors, ripple current	N	D	N	*.csv	<1GB	
Inv_Simul_Cir	Inverter simulation circuit in Simulink/Matlab	N	D	M	*.slx and *.m	<1GB	
InvDesign_PCB1	PCB file of inverter prototype design (Altium project)	N	D	M	*.SchDoc and *.PcbDoc	<1GB	
Inv_Control_uC	Control strategy implementation via microcontroller + coding (Code Composer Studio)	N	D	SO	*.out	<1GB	
Topo_Control report	Preliminary results of the inverter's topology and control strategy	N	D	T	*.pdf	<1GB	

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:

Existing climate data such as solar irradiance, ambient temperature, inverter operation data such as input & output voltages and currents, efficiency are collected from Niger and Belgium.

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.

- Yes

Inverter simulation files specify the way the PV inverter operates, so, it has the potential to be valorized,

Inv_Simul_Cir

Simul_Data_Gen

Printed Board Circuits and circuit schematics use to obtain the inverter prototype provide the required information to assemble the PV inverter and therefore, constitute fundamental information of the solution to be valorized.

InvDesign_PCB1

Inv_Control_uC

Written reports detail the principles, topology, control method and performance indicators of the PV inverter. Therefore, these documents contain relevant information subject to valorization

Topo_Control report

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).

- Climate and measurements datasets (Clim_Data, Simul_Data_Gen, Exp_Data_Gen) will contain in file information describing the measurement setup, equipment employed and notes in separate tab of the file.
- Circuit simulation files datasets will include a readme file describing its content (Inv_Simul_Cir)
- Micro controller scripts (Inv_Control_uC) will contain in file information as comments describing the code functions and variables.
- Printed circuit board and schematic files (InvDesign_PCB1) will contain in file comments describing the inverter plans and special considerations for implementation

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.

- Yes

Regular KU Leuven regulations. RDR will be used

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Other (specify below)
- Sharepoint online

How will the data be backed up?

- 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?

Energy Ville Share point lets to define different access levels where it can be easily defined with users within the organization have access to the project files

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

No data storage and backup costs as existing servers will be used.

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)?

- KU Leuven RDR

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

The long-term storage is guaranteed up to 10 years after the end of a project. This is stored on servers in Leuven, on the K-disk. The members of the research group have access to the data with the permission of the supervisor.

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 restricted data (upon approval, or institutional access only)

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

The collected data will be accessible to the PhD and PostDoc researchers, Mohamed Yasko and Adamou Moussa Issaka, and the responsible supervisors of the C2 project prof. Wilmar Martinez.

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.

- Yes, intellectual property rights

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.

- Other (specify below)

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.

- Yes, a PID will be added upon deposit in a data repository

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

No additional cost are foreseen.

Responsibilities

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

PostDoc researcher, Adamou Moussa Issaka.

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

PostDoc researcher, Adamou Moussa Issaka.

Who will manage data preservation and sharing?

Project supervisor, Prof. Dr. Ing. Wilmar Martinez.

Who will update and implement this DMP?

PostDoc researcher, Adamou Moussa Issaka.