LABORATOIRE D'ELECTROTECHNIQUE ET D'ELECTRONIQUE DE PUISSANCE DE LILLE

Master Thesis Project, 2025-2026

— Dynamic line rating in a climate change context for LV networks —

Supervisor: Ferréol Binot (ferreol.binot@centralelille.fr), L2EP – Ecole Centrale Lille and Stéphane Clénet (Stephane.CLENET@ENSAM.eu), L2EP - ENSAM

Context

As the world is pledged towards net zero carbon by 2050, the need for clean and efficient energy transitions is more critical than ever. Optimizing the power grid transfer capacity is crucial for maintaining grid stability and postpone grid reinforcements. Dynamic line rating (DLR) is the key method to optimize the ampacity of underground cables (UC) and overhead lines (OHL). Although this method is already used in high voltage power grids, it still needs to be enhanced in medium and low voltage for technical and economic reasons.

Objective

This master thesis will determine the maximum ampacity for UC and OHL in various realistic configurations. This determination is based on a finite element model, which integrate realistic environment. The results of the finite element model should be compared with analytical model and standard. To enhanced the study, the climate change impact on DLR should be considered.

Work steps

1. Conduct the state of the art on dynamic line rating in power grids.
2. Getting started with a finite element model for LV underground cables (UC) and adapt it to LV overhead lines (OHL). The UC finite element model is developed under COMSOL Multiphysics.
3. Determine the realistic maximum ampacity for UC and OHL in various configurations (urban/rural, summer/winter).
4. Compare the results of the finite element model with an analytical model and the NF C 33-226 standard.
5. Conduct a sensibility analysis of DLR model including climate change impacts.

Key words

Dynamic line rating, finite element method, climate change, low voltage grids, sensitivity analysis

Profile candidate

We are looking for a student who is curious and interested in electrical energy, power systems and finite element method. The candidate must have the ability to work independently, to well organize himself and also to implement a regular reporting with supervisors. Good writing skills and communication in English are mandatory.

Please send a CV, a motivation letter and the academic results of the two past years to ferreol.binot@centralelille.fr and stephane.clenet@ENSAM.eu.

Master "Electrical Energy for Sustainable Development"

References

[1] Câbles isolés et leurs accessoires pour réseaux d'énergie - Câbles de tensions assignées comprises entre 6/10(12) kV et 18/30(36) kV, isolés au polyéthylène réticulé à gradient fixé, pour réseaux de distribution, NF C33-226, AFNOR, 2016
[2] Montana S. and Michiorri A., The Climate Change Impact on Power Grid Transmission Capacity, 2024, https://hal.science/hal-04453957
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