G-SCOP
SCIENCES POUR LA CONCEPTION, L'OPTIMISATION ET LA PRODUCTION

THESIS SUBJECT G-SCOP 2021-2022

Title thesis: Contribution of machine learning and probabilistic modeling of uncertainties for the design and model-predictic control of distributed multi-energy systems

Thesis directors: Mathieu VALLEE (CEA), Jean-Marc MARTINEZ (CEA), Pierre LEMAIRE (G-SCOP)

Doctoral school : MSTII

Beginning of thesis : (souhaitée) : 1/09/2021

Funding envisaged - Context - Possible partners : CEA funding obtained (subject to the excellence of the candidate). The thesis will take place at CEA-LITEN (Grenoble).

Brief Description:

Taking uncertainties into account is key for model predictive control of distributed multi-energy systems (DMES), as well as for sizing these systems when optimal control is involved.

Solutions exist for dealing with uncertainties in optimization problems. However, fast computation is often required to allow for probabilistic methods, typically based on a Monte-Carlo approach. Designing models for fast computation introduces new uncertainties, related to the accuracy of the model compared to the real system under study. This source of uncertainty is hard to quantify, and can have huge impact on results if they outweight other sources of uncertainties.

In this PhD work, we propose to design, based on previous work at CEA, a method for simplifying optimization models in a way that is both appropriate for dealing with uncertainties and for using then in control and sizing of DMES.

The key novelty in this work will be on model uncertainty quantification and comparison with other sources on uncertainties, using innovative methods related to Bayesian Neural Networks and Deep Learning, in relation to more traditional physics-based modeling.

Contact(s) : Matthieu VALLEE (mathieu.vallee@cea.fr), Pierre LEMAIRE (pierre.lemaire@grenoble-inp.fr)