18 Months Postdoctoral Position

Contribution of Artificial Intelligence and Machine Learning Tools in the Selection of Tribological Coatings for E-Mobility

Context :

Electric vehicles (EVs) represent a significant lever in addressing anti-pollution standards within the framework of the fight against climate change. The shift to EVs evolves new technical and scientific challenges in term of design and efficiency of powertrain and drivetrain systems. Indeed, the mechanical components such as bearings, gears, transmission and axles are operating in a harsher mechanical and thermal environment compared to ICE [1]. For example, the bearing fatigue performance is subject to impacts from the high speed EV motors (up to 20 000 rpm) and from arcing generated from the fluctuation of current at a high frequency which, in turn, can lead to premature failure, and therefore requires the use of advanced surfaces technologies.

Project Description:

The project aims to leverage the use of artificial intelligence (AI) tools and machine learning (ML) to facilitate decision-making regarding the selection of coatings compatible with the environment and specificities of electric vehicles [2-3-4].

The first phase of the project involves a comprehensive analysis of available ML/AI methods, examining their applicability, strengths, and limitations in relation to tribological scenario requirements. An automatic reading tool for publications and patents will be implemented to extract literature data.

In the second phase, the project aims to validate and organize data into databases based on selected scenarios. Accuracy, reliability, and data consistency are essential to ensure result precision. Data quality improvement will be achieved using standardized methods for testing and data collection.

The third phase will involve the implementation of AI/ML algorithms using the previously obtained data. Finally, based on the AI/ML results, laboratory experiments will be proposed to validate and enrich the databases while strengthening the machine learning algorithm.

Your profile:

The following are some characteristics that may align well with the position:

- You should be a highly motivated researcher with expertise in some of the following areas: Machine Learning, Data Analysis, Python language and libraries
- You are expected to have a Ph.D. degree in Mechanical Engineering, Computer Science, Applied Mathematics or related field
- You should possess good English Language skills
- Working knowledge in Tribology or Surface Process will be appreciated

Duration: 18-Month Fixed-Term Contract for an Immediate Start

Location : CEMEF, Mines Paris, Sophia Antipolis (06), France

Partner: IMRA Europe, Sophia Antipolis (06), France

Team : Imène LAHOUIJ & Elie HACHEM (CEMEF, Mines Paris)
Radoslaw CHMIELOWSKI (IMRA Europe)

Application:

The application must include a resume (CV), a cover letter, the candidate's thesis and defense reports, as well as the contact information for two referees who can provide recommendations for the candidate.

Contact : Imène LAHOUIJ : imene.lahouij@minesparis.psl.eu

References

[1] Lubrication and tribology trends and challenges in electric vehicles. TLT Webinar (2020) https://www.stle.org/files/TLTArchives/2020/07_July/Webinars.aspx

[2] Jia et al. Design and development of lubricating Materials database and research on performance prediction method of machine learning" Scientific Reports (2019)

[3] Marian et al. "Current trends and applications of machine learning in tribology – A review" Lubricants (2021)

[4] Rosenkranz et al. "The use of artificial intelligence in tribology – A Perspective" Lubricants (2021)