

Internship on Fatigue life assessment of composite-to-metal bonded joints

Keywords: Fatigue, Mechanical tests, Machine Learning.

Context: Adhesive bonding technology is the most efficient method in terms of strength-to-weight ratio and design flexibility for joining composites to other materials, such as metals [1]. This leads to the application of bonded structures between dissimilar materials with asymmetric interfaces, the bi-material bonded joints. First applications of bi-material structures are found in aerospace industry [2-4] and nowadays have become essential in many other fields, such as automotive industry [5], maritime [6,7] and civil construction [8]. Even if the fatigue life of bonded joints tends to be longer than those with mechanical elements (bolted and riveted joints), the fatigue behaviour of bi-materials joints remains an up to date subject.

Fatigue tests are costly and time consuming, which makes the development of methods to reduce the number of testing series highly desired. In this project, the fatigue performance of dissimilar bonded joints will be assessed by using the thermographic technique proposed by Risitano [9]. This is an accelerated method originally developed to study the fatigue in metals. Prof. Silvio de Barros suggested the use of this technique to investigate the fatigue performance of metallic bonded joints [10]. Now the aim is to extend this study to metal-composite bonded joints. This important innovation can help to improve the knowledge about the fatigue behaviour of this type of joints. Together with the numerical model, it could potentially be a tool to design reliable joints for the industries where fatigue is a big issue [11].

This internship is part of a PhD project on the use of machine learning methods to reduce the amount of experimental data needed to characterize the fatigue life of assemblies with composite substrates [12]. Prof. Silvio de Barros and Prof. Pascal Casari are the PhD student advisors. Besides, Prof. Silvio de Barros and Dr. Sofia Teixeira de Freitas are applying for a Short Term Scientific Mission (STSM) in Delft, as part of the COST action project CertBond chaired by Dr. Teixeira de Freitas.

Missions:

- Literature review on the use of machine learning algorithms for the fatigue life prediction.
- Determination of test specimen parameters: geometry, materials properties, adhesives type, etc.
- Specimen preparation: composites substrates and bonded joints.
- Perform mechanical tests.
- Implementation of the machine-learning algorithm together with a PhD student.
- Writing a paper about the results obtained.

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Locations:

CESI Campus Saint-Nazaire, France.

GeM, IUT Saint-Nazaire, France.

(Probably 1 month at Faculty of Aerospace Engineering in Delft, Nederland)

Contract: internship of 5 to 6 months.

Profile: Student of Master or engineering school, in the field of civil engineering or mechanics of materials, motivated by experimentation and numerical simulations.

Application: Submit your application (including a CV and covering letter outlining your motivation for the position) to Prof. Silvio de Barros (sdebarros@cesi.fr).

Closing date: 31st January 2022.

References

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