Master Thesis - “Probablilistic small crack fatigue strength modelling of additively manufactured metals” (30 credits/20 weeks – 1-2 student[s])

About us

GKN Aerospace is the world’s leading multi-technology tier 1 aerospace supplier. With 33 manufacturing locations in 12 countries, we serve over 90% of the world’s aircraft and engine manufacturers. We design and manufacture innovative smart aerospace systems and components. Our technologies are used in aircraft ranging from the most used civil aircraft to the world’s advanced 5th generation fighter aircraft and the Ariane orbital rockets used by ESA.

Project Background

The mechanical performance of Laser powder bed fusion (L-PBF) produced materials is largely limited by uncertainties related to anomalies and defect such as gas pores and surface roughness features. Removing all remnants of defects and surface roughness features is difficult. Having access to validated defect resilient design methods is therefore important for the safe design of aerospace L-PBF parts. A common method for defect resilient design is linear elastic fracture mechanics (LEFM). Typically this works by assuming a large (~1 mm size) engineering crack subject to relatively low loads in order to fulfill LEFM criteria.

Equating L-BPF defects and surface features to cracks (a common assumption), they are generally smaller than a traditional engineering crack. Furthermore, if fatigue loads are high they can approach the fatigue limit of the L-PBF materials. Small cracks subject to high loads violate LEFM assumptions. This requires engineering methods that work for small crack growth at high loads. One such engineering method is the Kitagawa-Takahashi diagram modified with the El-Haddad small crack correction model.

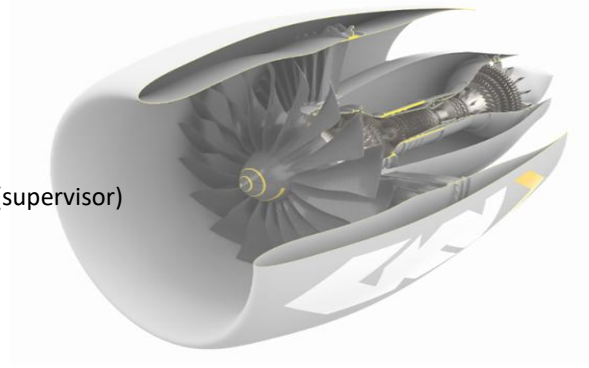
Assignment Description

Using statistical modelling the student is expected to create a method for building accurate Kitagawa-Takahashi diagrams using the El-Haddad model that is based on data gathered from advanced surface roughness measurements, mechanical testing and/or other material investigation techniques. This could include formulating a stand alone probabilistic description of the model or implementing commercially available options. The following thesis outcomes are expected:

- Litterature study of the subject at hand
- Material investigation with a focus on surface condition and it’s impact on fatigue strength
- Problem description and breakdown
- Model description and implementation
- A thesis defended both orally and in writing

Meritous Qualifications

- Pursuing a master’s degree in Engineering Physics, Mechanical Engineering or a similar field.
- Interest in Bayesian modelling and/or other applied statistical methods.
- Comfort working with Python, R or Matlab.



Applying

Send your resume and cover letter to Viktor Sandell, viktor.sandell@gknaerospace (supervisor)

Last date for application: 2025-12-14.