GKN AEROSPACE

Master Thesis - “Prediction of surface effects on fatigue life of areo engine components” (30 credits/20 weeks – 1 or 2 students)

About us

GKN Aerospace is the world’s leading multi-technology tier 1 aerospace supplier. With 55 manufacturing locations in 15 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

Fatigue life is one important requirement when designing critical aero engine components. Surface roughness can have a detrimental effect on fatigue and needs to be handled during life predictions. Normally, fatigue initiation cruves are established using results from smooth specimens with machined and polished surfaces. Any other surface condition is accounted for by e.g. knock down factors (KDF) established from four point bend tests of specimens with representative surfaces or by explicitly simulate a crack of a representative initial size growing from the surface. Ideally both approaches would predict the same life during similar loading conditions.

For laser powder bed (LPB) additive manufactured parts surface roughness has been identified as problematic with regards to fatigue properties. The surface roughness of these parts depends on the complexity of the geometry and its orientation in the build chamber, e.g. downskin, upskin and areas whit support structure will have very different surface roughness. Although surfaces are treated after the build it is likely that some roughness will remain and that it will differ between different locations of the part. To be able to account for varying surface roughness in the fatigue life predictions a method connecting a simple surface roughness measure to a KDF or a representative initial crack size is tempting.

Assignment Description

The work in this thesis will focus on surface effects on fatigue life predictions of LPB additive manufactured components and will be closely linked to ongoing GKN research activities and demonstrator projects. The thesis will cover:

- Literature studie to get an understanding of different LPB surface postprocessing technics, how surface rougness is affecting fatigue life and how to include effect of surface roughness in fatigue life predictions.
- Sensitivity study of life predictions with respect to different surface inputs and and modelling assumptions.
- Investigation into how a zoning strategy can be included in the FE analysis and life prediction of a component with varying surface roughness.

Qualifications

Student(s) in the final year of their M.Sc. studies in the field Mechanical or Aerospace engineering with an interest in solid mechanics and fatigue. Previous experience of FE analysis (e.g. in Ansys) and programming (e.g. in python) is recommended.

Apply by

Send your resume and cover letter to Rebecka Karrin, rebecka.karrin@gknaerospace.com

Last date for application: 2022-12-31. Interviews will be held continuously and the position could be filled prior to the last application date.