HEGEL

High cycle fatigue prediction methodology for fibre reinforced laminates for aircraft structures in CROR environment – development and validation

Background

ACARE SRIA's agenda is to achieve a 75% reduction in CO^2 emissions per passenger kilometre by 2050, reduce NOx emissions by 90% and perceived noise by 65%. These targets have led to the exploration of new material technologies and innovative advanced engine solutions. Among the engine solutions that are being considered, one of the most valuable technologies is the Contra Rotating Open Rotor (CROR) propulsion system.

The CROR propulsion technology offers a 15-20% improvement in fuel burn efficiency compared to current best technology. Successful integration of CROR requires changes in aircraft architecture; where high dynamic loads are transferred to the aircraft's primary structure, the fuselage can have highly stressed interfaces, there are high demands for vibration loading and potential fatigue issues.

The HEGEL project aims to develop and validate an advanced fatigue prediction methodology. This will include experimental testing and virtual approaches for predicting the long-term fatigue life of the composite laminates used in new structural architectures, and subjected to high sound pressure loading in a CROR environment.

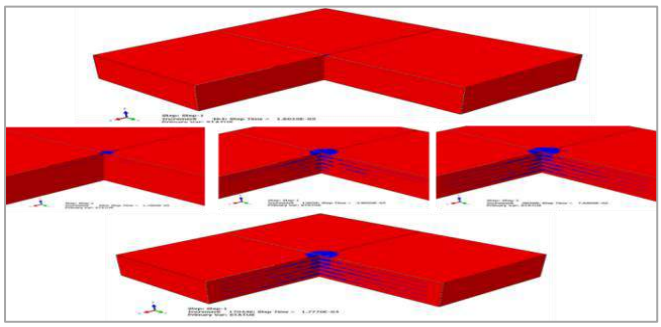
Objectives

The HEGEL project has the following objectives:

- to develop and manufacture a sound source and amplification system to investigate the response of specimens to high sound pressures representative of the acoustics and vibrations generated by a CROR
- to develop and validate a semi-empirical high cycle fatigue (HCF) prediction methodology based on master curves and shift factors, able to account for the effects of temperature and humidity in fatigue life, and the influence of the factors of high frequencies
- to develop and implement fatigue numerical FE models as virtual tools able to replicate the experimental testing, and extend the parametric study to cases not covered by the experimental programme.

Benefits

HEGEL technologies will provide a significant advance over current structural integrity assessments of composite materials during the design process. Current accelerated fatigue prediction methodologies are not fully validated for aerospace applications and only consider a limited number of parameters. This project will expand the potential of existing fatigue prediction methodology to additional environmental parameters, as well as to frequency dependent factors occurring at high frequencies during HCF. This will increase the capabilities and competitiveness of the European aircraft industry.



Project partners
TWI Ltd
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