Press Release – JANUARY 2023

Launch of EU-funded project D-STANDART

Developing fatigue test standards and AI-Aided Models for Composite Structures.

Advanced composites are gaining ground in many areas, especially aerospace, automotive and renewable energies, as they are lightweight and help to save energy. What is still missing are accurate and fast pre-production methods to optimise the durability of such large-scale composite structures. The aim of the EU-funded project D-STANDART is therefore to develop efficient methods to model the durability of large-scale composite structures of any design under realistic conditions.

What D-STANDART is about

Advanced composites play a crucial role in efforts to achieve a carbon-neutral future as enablers of resistant, lightweight and therefore energy-efficient structures, for example, in the aerospace and wind turbine sectors. The increasing use of large composite structures also raises the question of their damage tolerance and durability, which is currently generally assessed using imprecise and time-consuming techniques. Structures at these scales experience extreme loads and stresses, especially when optimised to use as little material as possible. Accurate and reliable fatigue assessment is therefore necessary to ensure the long-term integrity of the light-weight structures we need for a climate-neutral and sustainable future. Hence the objective of D-STANDART is to develop fast and efficient methods to model the durability of large-scale composite structures with arbitrary lay-ups under realistic conditions (loads, environment).

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State of the art

Currently, the lack of sufficient understanding of composite materials fatigue is typically dealt with using conservative design approaches to ensure that manufacturing defects or undetected impact damage do not lead to crack growth and catastrophic failure. While this cautionary-over-design approach ensures product safety, it does not allow for optimised weight and material use. Due to limited access to modern fatigue models for composites, manufacturers still rely heavily on expensive and time-consuming testing campaigns to validate their designs.

In fact, most composite material fatigue modelling in today's design tools is based on hypothetical extensions of metal fatigue models for composite structures. As a result, composite materials are not modelled using the latest science and therefore not used as efficiently or effectively as they could be with the updated models that have recently become available.

D-STANDART's approach

To unlock the full potential of composites to reduce structural weight and extend lifetime, thereby reducing environmental impact, D-STANDART tackles the problem from three angles: By accelerating the characterisation of the fatigue properties of composite materials, eliminating the need to test each type of lay-up individually, and finally, by developing the modelling capability to relate the behaviour of large-scale structures with complex geometries and potential manufacturing defects, to the results of coupon tests.

To this end, D-STANDART will develop new test methods using generic specimens to correctly quantify material parameters that determine the durability of composites under cyclic loading. By utilising high-frequency testing methods, testing times will be greatly reduced. This high-frequency testing will be enabled by scaling off the temperature dependency, thereby accounting for the self-heating that occurs during such testing. The material characterisation will be used in high-fidelity models to simulate defect growth in various lay-ups and at various scales as a function of cyclic loading and rate. To apply these models in an industrial design environment, D-STANDART will make use of Artificial Intelligence (AI) surrogate models, trained using test data from the project and historical test data to easily adapt to different design parameters and complex lay-ups, thereby accelerating the development, uptake, and commercialisation of advanced components.

Two use cases have been selected to validate the modelled durability performance in the aerospace and renewable energy sectors. Furthermore, circularity and sustainability will be assessed via dedicated life-cycle assessment, life-cycle costing, and cost-benefit analysis.

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The consortium

D-STANDART involves nine partners (three universities, two RTOs, two industrial companies and two SMEs) from four countries (France, Germany, the Netherlands and the United Kingdom). The Advisory Board consists of six end-users (Rolls Royce, Fokker Aerostructures, Leonardo, Siemens Gamesa, Embraer, Coexpair) and will support the consortium by validating requirements, guiding the project's approach to certification, and finally supporting results' uptake in tight alignment with the European Materials Modelling Council (EMMC) and European Materials Characterisation Council (EMCC).

The partners (short names in brackets) are:

1. ROYAL NETHERLANDS AEROSPACE CENTRE (NLR), NL
2. UNIVERSITEIT TWENTE (UT), NL
3. UNIVERSITY OF BRISTOL, UB
4. NCC OPERATIONS LIMITED (NCC), UK
5. iCOMAT LIMITED (ICO), UK
6. TECHNISCHE UNIVERSITEIT DELFT (TUD), NL
7. MSC SOFTWARE GMBH, a Hexagon Company (HMI), DE
8. L - UP SAS (LUP), FR
9. SE BLADES TECHNOLOGY BV (SUZ), NL

Key facts

Full title: "**Durability Modelling of Composite Structures With Arbitrary Lay-up Using Standardized Testing and Artificial Intelligence**".

D-STANDART is a three-year research project funded by the European Commission under the Horizon Europe Programme (**grant agreement number 101091409**) with a total budget of 5.6 million Euros.

Official starting date: [01-01-2023], project kick-off meeting: [31-01-2023].

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