

Bachelor's / Master's / Diploma Thesis

Deformation measurement on lightweight rotors at supersonic surface speeds

Motivation

The development of highly efficient turbomachines is crucial for the reduction of CO₂ emission in air traffic. Due to their high stiffness-to-density ratio, fiber reinforced polymers (FRP) are predestined for the construction of efficient large diameter high-speed fan blades. However, their inhomogeneous behavior impedes failure prediction. Numerical models need to be validated by in-situ measurements on rotating specimens. Therefore, FRP rotors are accelerated to surface speeds above 300 m/s inside a test rig until they burst.

A camera based technique shall be investigated for deformation and vibration measurements with high spatio-temporal resolution and low uncertainties, even at high surface speeds. The technique is based on the application and the optical readout of diffraction gratings on the rotor surface.



Fan blade of a GE90 -Turbine in Boeing 777 [GE18]



Optical sensor on FRP rotor inside test rig

Tasks

- Implementation of a novel data acquisition approach
- Experimental validation of the method
- Determination of the uncertainty budget

Key words

Optical strain measurement, High-speed, Signal processing, MATLAB, C++

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[GE18]

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