Bachelor‘s / Master‘s / Diploma Thesis, ET/MT/MB

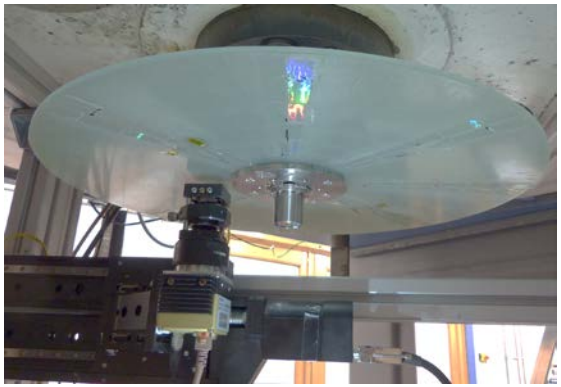
Measuring the structure dynamic behavior of high-speed lightweight rotors

Motivation

The development of highly efficient turbomachines is crucial for the reduction of CO_2 emission in air traffic. Due to their high specific stiffness and tensile strength, fiber reinforced polymers (FRP) are predestined for the construction of large diameter high-speed fan blades. To investigate the dynamic behavior of such structures, FRP rotors are accelerated to rotational speeds above 200 Hz inside a vacuum chamber. The challenge is the spatially resolved measurement of deformations and vibrations with low uncertainties and at surface speeds over 1000 km/h. For this purpose, an optical diffraction grating based approached is investigated.

The suitability of the diffraction grating method to measure vibrations of mechanically excited rotors shall be experimentally determined. Furthermore, the results shall be compared to available strain gauge and distance sensor techniques.

Rolls Royce UltraFan engine [RR19]



Optical sensor inside rotor test rig

Tasks

- Adaptation of the data acquisition for vibration measurement on rotating specimen
- Comparison to electrical strain gauges and distance sensors
- Determination of the measurement uncertainty

Key words

Optical measurement, experiments, MATLAB

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[RR18] rolls-royce.com/media/press-releases/2019/25-02-2019-rr-ultrafan-one-step-closer-as-advanced-low-pressure-system-alps-testing-gets-underway.aspx (05.03.2019)