

High-resolution strain sensor for fast rotating structures

Motivation

Due to their lightweight properties, fiber reinforced polymers (FRP) are predestined for the development of high-speed rotors, such as electrical machines and flywheels. To validate and calibrate numerical models, in-situ deformation measurements during rotation are necessary. The challenge is to enable full-field measurement with low uncertainty at surface velocities up to 1 km/s.

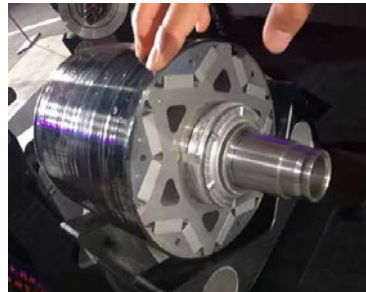
We developed an optical diffraction grating sensor which measures deformations with high spatiotemporal resolution and precision at arbitrarily high surface velocities. Currently, the readout unit is redeveloped for improved accuracy and an additional measurement direction.

Contact

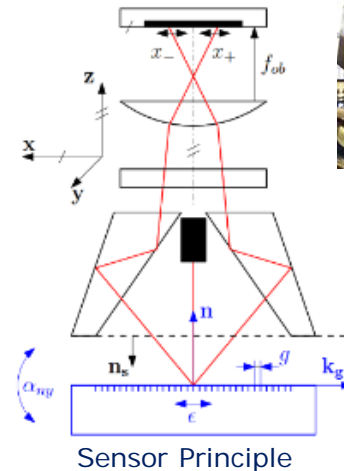
M.Sc. Julian Lich

- E-Mail: julian.lich@tu-dresden.de
- Internet: tu-dresden.de/et/mst

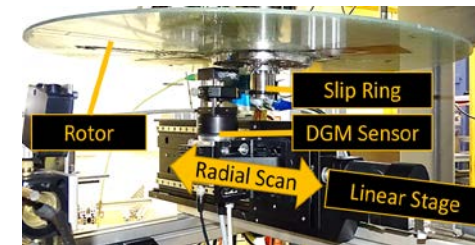
Electrical Engine with Carbon FRP Sleeves



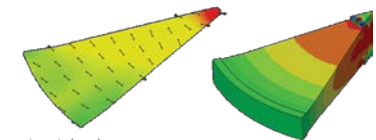
Carbon FRP Flywheel



Sensor Principle



Measurement in Test Rig



testdevices.com

Deformation Map

Tasks

- Add and characterize a triangulation sensor module to the readout unit
- Rotor deformation measurement in a real test rig
- Build and characterize a read-out unit based on position sensitive devices

Key words

Rotor dynamics, optical strain sensor, diffraction gratings