

Rotor Test Rig MERIT – Optimising Blade Deformation Measurements in a Rotating System

Background:

The MERIT test rig is a whirl tower featuring an 85kW motor and constant-rpm control, along with a wide array of sensory equipment capable of measuring rotor blade behaviour in a rotating system for a variety of extreme flight conditions. The most novel technology being implemented for data collection is the GOM ARAMIS SRX Optical sensor setup, combined with their Digital Image Correlation (DIC) Software, allowing us to measure the blade's deformation profile during operation. While this has been tested and developed to a rudimentary extent, there is plenty of room for optimisation and experimentation within the context of the test rig.

Project Outline:

The DIC software functions by recognising hyper-reflective stickers stuck onto the surface of the blade, however, until this point, the constellations of stickers used have been randomly generated by eye, meaning they are frequently either recognised incorrectly or not at all; and it's not known which parameters (RPM, Collective Pitch, Measurement Distance etc) are the dominant factors that affect this. The first stage of the investigation would involve identifying which point constellations are optimal for our setup, and which parameters can be tweaked to optimise constellation recognition.

Currently, the stickers protrude from the surface of the blade which reduces aerodynamic performance, so initial work is already under way attempting to integrate these stickers into the carbon fibre structure during lamination. The thesis work would expand upon that, identifying e.g. whether the integrated stickers behave differently to the stuck-on stickers, and whether they benefit from slightly different setups etc.

Prerequisites:

Primarily: the ability to think creatively and work your way into a topic independently.
Understanding of Rotor systems required; experience with DIC ideal but not necessary.



Fig. 1: The MERIT Test rig, without blades attached

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