Semesterarbeit / Master Thesis

Institute of Helicopter Technology

Rotorcraft Comprehensive Analysis Validation Framework

Description:

Rotorcraft comprehensive analysis involves establishing a high-fidelity representation of a helicopter rotor, using accurate rotor structural properties and drivetrain multibody model, and judiciously applying structural and aerodynamic modeling strategies. This is a standard analysis framework, used in the industry and academia alike, where one of the main goals is to obtain the overall aerodynamic loads and elastic deformation loads (structural loads) experienced by a helicopter rotor at a prescribed operating condition. Reliable information of such loads is of immense value to guide blade and drivetrain properties that are desirable for more optimized designs. A rotorcraft analysis model can be deemed 'reliable' when it is capable of predicting such dynamic loads experienced by the rotor drivetrain that match well with corresponding experimental measurements made using the same rotor setup in well-conditioned wind tunnel or flight test setting.

Goal:

A Bo 105 rotor has been modelled using the state-of-the-art numerical strategies solving for the blade structural dynamics and the rotor aerodynamics. This model constructed using an in-house analysis in C-programming language will be made available to the student. The goal is then to compare computational predictions based on the aforementioned model with experimental measurement data available from full-scale rotor wind tunnel tests. These measurements were only recently published and include blade loads, hub vibration, rotor acoustic noise, control loads etc, in the time and frequency domains – essentially a treasure trove of data for computational engineers! Comparison of computational predictions with a rich set of experimental measurements (at various operating conditions) provides the opportunity to identify, and attribute, mismatches to specific modelling strategies or physical phenomena. Working with a comprehensive analysis model and experimental data of this scale provides the unique opportunity to develop an overall understanding of the methods involved in analyzing rotorcraft loads and performance with high fidelity.

Skills and Tools:

Fundamental understanding of rotorcraft physics required.
Also, programming in Python.

Language:

English

Start:

Flexible

Contact:

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