Semesterarbeit / Master Thesis / IDP

Institute of Helicopter Technology

High-fidelity Rotorcraft Comprehensive Analysis Toolchain

Background:

Rotorcraft industries are constantly striving to improve rotor blade structural and aerodynamic design, while minimizing production costs. For this purpose, prediction tools capable of *comprehensively* analysing rotorcraft performance and loads are being relied upon to provide accurate estimates of structural stresses on rotor blades and other relevant components. The architecture of such modern analysis tools is fairly modular, allowing simulation of even exotic rotorcraft concepts with modeling capability down to the friction between various joints and hinges in the rotor drivetrain. At the heart of such a tool are two most important modules – blade aerodynamics and rotor wake solver, and blade elastic deformation solver – that iteratively solve for the periodic elastic blade motion/deformation given particular operating conditions of the rotorcraft.

Goal:

The Institute of Helicopter Technology extensively works with a rotorcraft comprehensive analysis code called Dymore (http://www.dymoresolutions.com/), written in C, and is working on expanding it. The goal is to simulate the operation of an active rotor (see figure below) with a high degree of fidelity. The aerodynamics module currently within Dymore is incapable of carrying out such analysis with requisite fidelity. So, a higher-fidelity rotor aerodynamics solver is planned to be coupled with Dymore for this purpose. The challenges of coupling this new solver include

- **Coupling** – since the two solvers are independent codes, a coupling mechanism needs to be established whereby the structural solver (Dymore) accepts the aerodynamic loads and passes on the calculated structural deformation to the aerodynamics solver, and vice versa.
- **Code speed-up** – rotor aerodynamic flowfield solutions can take up to 2 orders of magnitude more time, compared to Dymore standalone solution, to converge. Optimising the coupling procedure, through detailed profiling, is paramount to ensuring optimised solution time of the coupled analysis framework.

All of the above is to be carried out while retaining complete backwards compatibility with the current Dymore (standalone) framework.

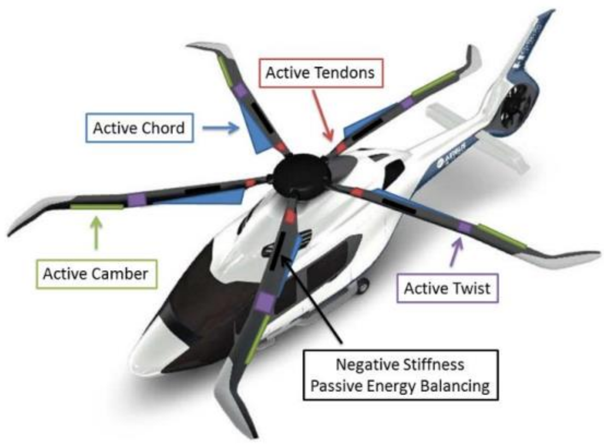
Skills:

Basic understanding of rotorcraft physics helpful but not necessary

Tools: C/C++

Language: English

Start: As soon as possible



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