Master thesis or Interdisciplinary Project (IDP)

at the Institute of Helicopter Technology

Helicopter Fluid-Structure Coupling using preCICE

Background:

In the field of rotorcraft simulation, rotor performance and structural loads are modeled by means of comprehensive rotorcraft analysis tools. These software packages also solve for blade motion and rotor trim conditions. However, in these tools, aerodynamic phenomena, such as the rotor wake or rotor inflow are predicted using lower-order aerodynamic models. Thus, in order to improve the numerical accuracy of the fluid-structure interaction on the blade, comprehensive rotorcraft analysis tools are coupled with computational fluid dynamic (CFD) tools that solve the 3D Navier-Stokes equations and can provide advanced 3D aerodynamic calculations.

In order to **exchange** aerodynamic loads and structural deformation information between the **CFD solver TAU and the structural solver CAMRAD II, preCICE** was used as **a coupling library.** In a previous study, **preCICE adapters** for TAU and for CAMRAD II were developed to couple the two solvers.

The proposed study aims to improve the **efficiency** and **functionality** of the **existing adapters.**
It will focus on the convergence of the coupling between the CFD and TAU solvers by comparing explicit and implicit coupling approaches. Additionally, the focus will be on input/output routines to speed up calculation time by replacing filesystem I/O with more efficient communication channels. These improvements should increase the predicted accuracy of the solutions for the rotor performance and loads. In future investigations, the developed adapters will allow the investigations of adaptive azimuth-dependent structural deformations on an active rotor (see Figure).

Skills:

Python Programming, Working in a Linux environment

Language:

English or German

Start:

Flexible (Best April/May 2020)

Contact:

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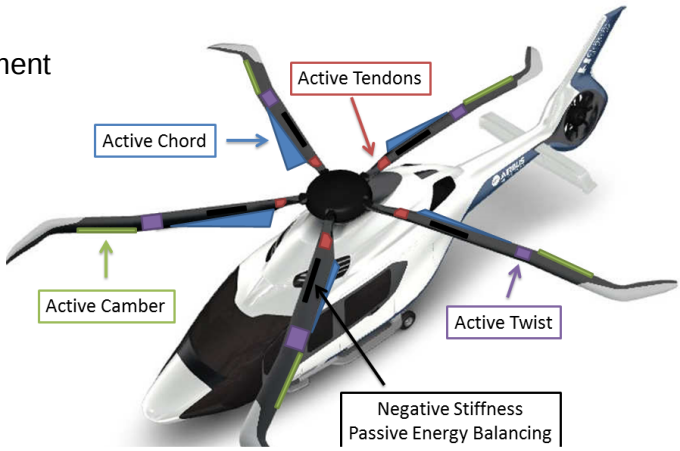

Figure: Shape adaptive blades as envisioned by SABRE