Master Thesis

Institute of Helicopter Technology

Numerical investigation of aerodynamic interference in rotor tests under Martian conditions

(Simulation)

Keywords: CFD, Damping, Mars Helicopter, Aerodynamics, UAVs, Simulation

Background:

The next step in Martian exploration will be UAVs that can cover larger areas that rovers cannot reach. The currently operating Mars Helicopter Ingenuity by NASA is the first technology demonstration of this development. To actually use UAVs to gather scientifically relevant data, their range and payload capacity has to be increased. The most critical component of such UAVs are the rotor blades which have to generate thrust in the thin atmosphere while being extremely light. This is why we plan to build and test such blades in an upcoming project. For the testing a near vacuum of 8 mbar is necessary which means that the tests have to be performed in a special chamber normally used for space simulation in satellite tests. The largest chamber of its kind in Germany is the Weltraumsimulationsanlage (WSA) at iABG in Ottobrunn. Due to its shape and orientation the test rig will have the rotor outflow not in the direction of the cylindrical chamber but perpendicular to it. This will lead to aerodynamic effects that have not been studied yet, especially under these atmospheric conditions.

Goal: Those effects will be investigated with a CFD simulation of the rotor. First, a CFD mesh of the chamber will be generated. The rotor will be modeled as an actuator disk. To evaluate the influence of the chamber simulations will be performed by modeling different size rotors in the WSA and in open space as reference. The goal of the study will be to analyze the influence of the chamber on the rotor inflow and performance. The results will influence the decision which size rotor can be tested in the WSA without skewing the test results due to interference.

About us: We are looking for an independent and highly motivated student in his Master's who has experience in working with CFD. This thesis offers a great opportunity to investigate a setup that has never been studied and to contribute to the exciting new field of Mars aerial exploration. When interested, please feel free to contact us in person. We are happy to discuss all possibilities! We also offer a great range of thesis and Hiwi opportunities at the moment.

Skills: High motivation and the ability to independently familiarize with new topics. Experience in CFD and fluid dynamics.

Tools: Star CCM+or equivalent (CFD) / Catia
Language: English/German
Start: As soon as possible
Contact:

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