HAW HAMBURG

DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

CFD Tool VSPAERO:
Actuator Disk and Flow Visualization

Task for a Master Thesis

Background

Conceptual aircraft design calculates approximately 50 fundamental parameters for the aircraft. To obtain a 3D representation of such a geometry, OpenVSP (https://openVSP.org) can be used. OpenVSP-Connect (http://openVSP.Profscholz.de) helps, converting the calculated design parameters into an OpenVSP model. OpenVSP is bundled with VSPAERO, which offers aerodynamic analysis capabilities using the Vortex Lattice Method (VLM) and the Panel Method. VSPAERO incorporates actuator disks that can be employed to include jets or propellers into the aerodynamic model. VSPAERO provides possibilities for visualization of results. For example, wakes and pressure coefficient changes can be displayed. In his thesis, Floris Märien combines testing of VSPAERO with providing help to get started with the program. Real world aerodynamic questions are answered in example problems. The idea for this thesis is to continue along this path.

Task

Show how to use the actuator disk to integrate jets into aerodynamic analysis and flow visualization. Here are the detailed tasks:

- Literature review of the software OpenVSP.
- Literature review of the aerodynamic fundamentals of VSPAERO.
- Literature review of the actuator disk theory.
- Discretization studies to determine the balance between correct and reliable results and short simulation time.
- Discretization studies to determine the best disk parameters for aircraft jet engines.
- Comparison of aerodynamic results for different engine locations.
- Selection of the best engine location based on preliminary aerodynamic results only, using the Airbus A320 geometry as an example.

The report has to be written in English based on German or international standards on report writing.