Bachelor Thesis / Project Thesis / Internship
Implementation / Enhancement of a FlowSimulator Interface for MSC’s Nastran

Background:
In a joint project of Airbus, Cassidian, Onera, DLR and universities the FlowSimulator (FS) software environment is being continuously developed. For the partners FS is meant to serve as the backbone for massively-parallel multi-disciplinary simulations. In particular fluid-structure coupled simulations have urgent relevance. The kernel of FS is represented by the FlowSimulator Data Manager (FSDM) implemented in C++. In accordance to the FS design dogma all simulation data must be communicated with the FSDM, i.e. fluid and structures meshes as well as the respective solutions, see fig. on the left. With the Python layer available under FS complex process scripts can be rapidly developed, e.g. a CFD-CSM coupling process as is sketched in the upper left figure. In the fig. FSTau represents the FS version of DLR’s CFD solver TAU. A central component in the sketched process is the FSNastranInterface. It performs the communication between FS and MSC’s structural solver Nastran, reads the structural mesh and additional data from file to the FSDM, and handles the input and output files of Nastran.

Work content:
In your work you will implement/enhance an existing prototype implementation of FSNastranInterface and improve its integration into the FlowSimulator. Wherever possible, data parallelism within the meaning of domain decomposition in the interface is to be used. You expand the BDF reader and writer of the interface which provides the communication of the structure mesh with the FS. The structural deformation computed by Nastran must be read by the interface from Nastran’s OP2 files. Therefore, you will implement an OP2 reader into FSNastranInterface. In addition, modal solutions computed by Nastran and stored by Nastran in OP4 files have to be made available in FS. Therefore, you will implement an OP4 reader into FSNastranInterface. Finally, you will test the functionality of all of your implementations in static aeroelastic simulations with test cases of increasing complexity, e.g. wing model, wing-fuselage model, and full aircraft model as shown in lower left figure.

Requirements:
Valid candidates should have or are willing to fastly acquire the following skills
- Understanding of structural mechanics
- Experience with MSC's Patran/Nastran
- Programming skills in Python (or related scripting languages)
- Experience with Unix/Linux OS

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