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Implementation of periodicity for meshing strategies and application to CFD simulations for turbomachinery structures with elsA solver

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3 Abstract

My name is Valentin Duvivier and this report aims at giving an insight into my graduating internship.

It takes place at ONERA, the french aerospace lab, in their DAAA laboratory, which mainly handles numerical calculation on aerodynamic structures, such as helicopter blades [1], wings [2][3] and turbo-machines [4].

My internship takes place in this research laboratory (DAAA), under the supervision of M. Sâm Landier, specialized in meshing strategies. My mission stands as : "Implementation of periodicity for meshing strategies and application to CFD simulations for turbomachinery structures with elsA solver".

It consists into the modification, debug and implementation of python and C++ codes, that I only did. Then, except if otherwise mentioned, the following content has been the product of my work, supervised and adviced by M. Sâm Landier. These codes eventually are implemented along with existing codesqiming at large numerical calculation of aerodynamic structures generally speaking.

4 Introduction

At the interaction between fluids and structures, the study of a turbomachinery system can take place at different level, from the study of the flow that goes through it, to the study of the breaking limit of the shell and the consistency of the mesh regarding flow characteristics.

In this context, the ONERA ensued a master internship to better develop the matter, extending existing meshing strategies in order to better stimulate complex fluid/structures interactions and transcribe flow properties. In particular, my mission during my internship is to enhance existing codes for turbo-machine applications by developing periodicity methods, and extend these codes furthermore.

In the one hand, the point is to implement new C++ and python codes to ensure periodicity in the mesh stimulating an interaction fluid/structure. On the other hand, the objective will be to test the developments committed in the case of well referenced turbomachinery cases such as CM2012 case, a turbo-machine blade crossed by a transversal choc.

Eventually, as the first points are being tackled down, other missions will add to this main one such as improving the code's robustness to complex geometries, develop a multi-processor calculation system and further work on CAO geometry.

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