**Preliminary steps towards the reconstruction of pressure fields from PIV measurements**

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Abstract

Within the European Project ASTORIA, innovative combined swirl / total pressure distortion generators have been designed and tested. The experimental characterization was carried out in the VKI R4 closed loop rig and relied on 2D-3C Particle Image Velocimetry (PIV) measurements. This setup is particularly convenient from the perspective of analysing detailed flow features and to support the validation of the design methodology; however, it does not allow for the computation of distortion indices, parameters still largely employed within the design phase of the downstream turbomachinery components.

In order to fill this gap, at VKI, two different techniques are currently under development to perform the reconstruction of pressure fields (and hence of distortion indexes) out of PIV and wall static pressure taps measurements. The first approach employs a space-marching integration of the Navier-Stokes momentum equation while the second is based on the solution of the Poisson pressure equation. In the present paper, the mathematical support is firstly described and the techniques are validated against numerical simulations of an open-literature total pressure distortion case. As a result, reconstruction error metrics are obtained together with a sensitivity analysis (Global Sobol’s indices) with respect to the effect of input parameters, with particular attention posed on the effect of axial gradients and compressibility.

At its final extent, the current paper coincides with a design of experiment for the final measurement campaign.

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