On Dynamical Structures behind a stage of an axial air test turbine

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Abstract

It is well known that the flow in an axial turbine is highly turbulent, especially close to the turbine blade stages. The intensity of turbulence could reach in those regions high values, higher than 10%, see e.g. [1]. However, the dynamical structures responsible for the turbulence generation have not been explored in sufficient details yet.

In the paper the dynamical structures are studied in the plane located behind the stator/rotor stage of an axial air test turbine. The Particle Image Velocimetry (PIV) measuring technique was used in the experimental research, data acquisition was synchronized with the rotor displacement to obtain statistical data set to a given rotor phase angle. The dynamical structures, predominantly vortices and shear regions, were identified on the statistical basis using the Proper Orthogonal Decomposition (POD) method. The typical high kinetic energy patterns are extracted from the fluctuating velocity field.

The dynamical structures could be related to the wakes behind the individual rotor blades and the inter-blade channels flow instabilities.

References

[1] T. Jelinek, M. Nemec, V. Uruba, “Flow Parameters Simulation Technique in Annular Turbine Cascade Inlet”, Engineering Mechanics 2016, Edited by: Zolotarev, I; Radolf, V (2016)