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POD analysis of the unsteady behavior of the wake under the influence of laminar to turbulent transition in a compressor cascade¹ LEI SHI, HONGWEI MA, LIANPENG ZHAO, Beihang University — For low incidence angle and Reynolds number, the transition region is usually located closer to the trailing edge, which leads to a strong interactions of the vortex shedding of the laminar separation bubble and the wake flow. In this paper, particle image velocimetry (PIV) measurements have been performed in order to analyze the unsteady flow field in a compressor cascade. The instantaneous snapshots have been post-processed by means of proper orthogonal decomposition (POD). The first mode pair allows the application of a correlation-based method to correctly sort each PIV instantaneous image in the wake period. For all the time steps, according to the extent of the deviation between the time-averaged flow field and the phase-averaged counterpart, the flow field can be divided into three regions associated with the LSB vortex shedding, the wake flow and the interaction between the former two dynamics. The triple decomposition of the velocity fluctuations enables the quantification of the contribution associated with the three coherent motions as well as the stochastic motions to the overall velocity fluctuations.

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