

## METHODS OF UNSTEADY FLOWS CONTROL IN TYPICAL HIGH LOADED HPC STAGES WITH THE AIM OF GASDYNAMIC EFFICIENCY IMPROVEMENT

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### Abstract

This work represents the results of "passive" unsteady flow control methodologies developed for high-loaded advanced High Pressure Compressor (HPC) stages. Among others such methodologies include casing treatment, installed over rotors and stators. CIAM has a long-time experience in high-efficient slot type casing treatments developed for the surge margin increase by 4-6% and efficiency - by 0.5 ÷ 1.5% within the total operating range. Experimental investigations are carried out with a high-loaded Stage A1 (typical HPC first stage) with pressure ratio equal to 2.28. In the frames of this work a two stage compressor with a unique design was developed to investigate influence of tip clearance values on rotor and stator clocking effect. Widening of surge margin of a transonic compressor stage D-66 and D-77M is the main objective of the paper. These stages are typical middle and last stages correspondingly of a modern High Pressure Compressor (HPC) with decreased number of stages.

**Keywords:** Efficiency; Surge margin; Casing treatment; Unsteady flow control