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# AERODYNAMIC STUDIES OF AIRCRAFT ENGINE TURBINE STAGE

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**Rezumat.** *Studiile aerodinamice ale unei trepte stator-rotor pentru turbinele de motor de avion sunt efectuate computațional folosind metoda Large-Eddy Simulation (LES). Scopul acestui studiu este de a modela dinamica fluidului în această treaptă a motorului și în mod particular interacțiunea dintre palele rotorului și vârtejul format de stator. Calculele computaționale sunt efectuate pentru un regim variabil rotațional al rotorului. Studiul este efectuat pentru un număr Reynolds Re=1.3x10$^5$. Studiul prezent arată faptul că interacțiunea dintre vortexul format de stator și paleta rotorului produce o variație în timp a coeficienților specifici aerodinamici.*

**Abstract.** *The present research concerns the aerodynamic computational studies of stator-rotor turbine stage. The computational studies are carried out using the large-eddy simulation approach. In the aircraft engine compressor/turbine stage blade-vortex interactions occur. The present study aims at the understanding the blade-vortex interaction mechanism and its impact on the aerodynamics of rotor-stator compressor/turbine stages. The computational studies are carried out in a rotating frame of reference, for high-Reynolds number flow, Re = 1.3x10$^5$. The analysis reveals that the blade-vortex interaction causes the flow separation on the stator stage and a time-varying lift and drag.*

**Keywords:** numerical modeling, finite-differences, cavity flows

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## 1. Introduction

Aircraft engines are complex thermodynamic systems that operate under a wide range of aerodynamic and thermal conditions, while these conditions define the propulsion efficiency of the engine. One of the challenges associated with the aircraft engines are the high-temperatures developed in the turbine stage. The high-temperature is due to the hot gases exiting from the combustion chamber, as schematically shown in Figure 1. The high-temperature affects the turbine blade

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