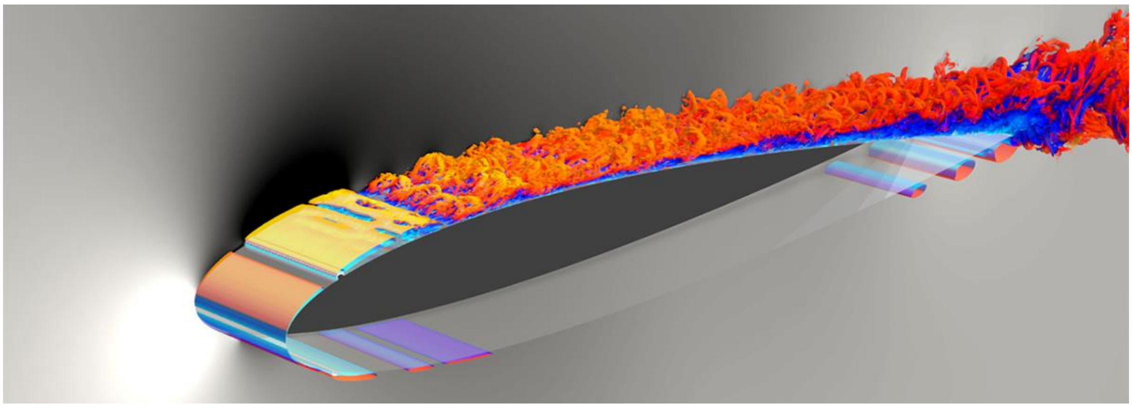
Graz University of Technology
Technische Universität Graz
Erzherzog-Johann-Universität

Institut für
Thermische Turbomaschinen
und Maschinendynamik
Vorstand: Univ.-Prof. Dr.-Ing. Franz Heitmeir
Inffeldgasse 25/A, A-8010 Graz
Tel. +43(0)316 873 - 7226
Fax +43(0)316 873 - 7234

Master thesis

Investigation of the boundary layer transition in a linear turbine cascade flow using Large Eddy Simulations (LESs)

The boundary layer represents the region of flow closest to the wall where the viscosity plays a main role. Typically, a boundary layer can be laminar or turbulent and the process of a laminar boundary layer turning into a turbulent one or the other way round is called boundary layer transition. Boundary layer transition has strong influences on the exchange of momentum and heat transfer between the airfoil and the flow. Being able to predict the point where transition occurs is mandatory in modern turbomachines in order to achieve high performances and high efficiency.



Computational fluid dynamic (CFD) is an efficient tool to study the phenomenon. Different numerical models can be used such as RANS, LES or DNS. DNS (Direct Numerical Simulation) is without any doubts the most accurate model for simulating the boundary layer transition but it is still far to be considered efficient and for this reason it is mostly used in research fields and with simple geometries. RANS (Reynolds Averaged Navier Stokes) models, on the contrary, are easy to use but they suffer from low accuracy if applied to complex geometries. LES (Large Eddy Simulation) is somewhere in between the two approaches since part of the fluctuations of the flow field is directly computed in the equations as in a DNS whereas the contribution of the smallest eddies is taken into account by a turbulence model as in a RANS. In terms of performances LES is more accurate than a RANS model and less time consuming compared to a DNS. For these reasons it is considered the state of the art for simulating the boundary layer transition.

The aim of this work is to simulate the boundary layer transition in a turbine cascade using LES. Initially, RANS simulations will be used to extrapolate information about the turbulent length scales. Then the results will be used to design the grid for the LES case. Finally, a comparison with measurements of the turbine cascade will be made.

Beginning: available now
Duration: 5-6 Months
Language: English

Contact: Dott. Mag. Ettore Bertolini
E-mail: ettore.bertolini@tugraz.at