ETC15 Session:
Achievements of the ARIAS project

Session content and agenda

European Turbomachinery Conference
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ARIAS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769346.

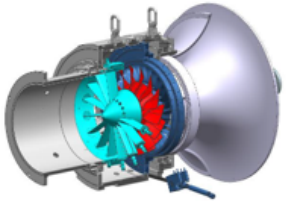
ARIAS project summary

The EU project “ARIAS” (“**A**dvanced **R**esearch **I**nto **A**eromechanical **S**olutions”) was carried out between 2018 and 2023 by a consortium of 19 partners from industry, research institutes and academia within the European Union’s Horizon 2020 research and innovation programme under grant agreement No 769346.

The overall goal of the ARIAS project was to improve the design methods employed by aircraft engine manufacturers to predict aeromechanical vibrations which occur due to the interaction of the component vibration with the air flow through the machine. The physics involved in aeromechanical processes is complex and current industry standard methods are limited in their ability to predict when aeromechanical vibrations will affect the structural behaviour of the machine. In-practice, the limitations of current methods generally lead to over conservative designs, where unwanted aeromechanical behaviour is avoided at the expense of cost, weight and complexity in the components. Having access to more reliable design methods will enable optimisation of aeromechanically acceptable component designs, facilitating the production of more efficient, reliable and quieter engines.

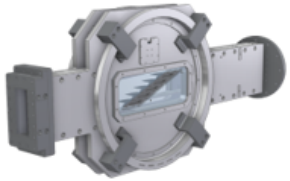
The specific objectives of the ARIAS project were to: i) improve the design methods employed by aircraft engine manufacturers to predict aeromechanical behaviour; ii) expand the available database of experimental aeromechanical measurements; iii) develop validated analytical methods that can be used to support engine certification, and by that reduce product development time and costs; iv) advance the state of the art in the understanding of the underlying physics of aeromechanical vibrations: v) investigate new and advanced technologies for the mitigation and monitoring of aeromechanical vibrations

Test facilities used in ARIAS project



TUDA Transonic Compressor Rig

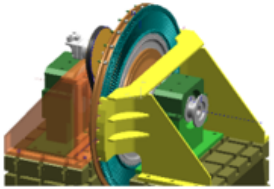
USTUTT Compressor Rig



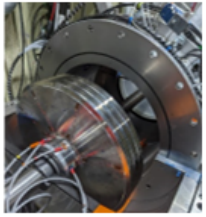
KTH Transonic Linear Cascade

CTA Low Pressure Turbine Rig

ECL Vacuum Rotating Rig



Avio Aero Spin-rig



Imperial College Seal Flutter Rig

The largest component of the project was the experimental work, utilizing test facilities located in seven different locations across Europe: Technical University Darmstadt (Germany), École Centrale de Lyon (France), KTH Royal institute of Technology (Sweden), University of Stuttgart (Germany), Centro de Tecnologias Aeronáuticas (Spain), Avio Aero (Italy) and Imperial College (UK). Some of these facilities are entirely new, commissioned and used for the first time in this project.

The high-quality data generated in those experiments is used to validate and improve the simulation methods used in design, as well as to contribute to enhanced understanding of the underlying physics of the aerodynamically induced vibrations of the blades and labyrinth seals..

Session agenda

Abstract

The aim of this session is to review the main achievements of the Horizon 2020 project ARIAS (Advanced Research Into Aeromechanical Solutions). The introductory part of the session will provide a general overview of the project objectives, structure and activities. The subsequent presentations will focus on the three main areas of interest addressed within the ARIAS project: forced response in transonic compressors, non-linear aeroelastic interactions in turbine bladed discs and labyrinth seal flutter. The proposed presentations will discuss in detail the experimental campaigns and related analytical & numerical investigations carried out in the project, as well as some of the main results achieved. In addition, some special attention will be put on the advanced methods and technologies for the mitigation and monitoring of aeromechanical vibrations, which were assessed during the project.

	Duration	Title	Presenter
1	10 mins	General overview of the ARIAS project	Nenad Glodic KTH
2	30 mins	Advanced understanding and quantification of compressor forced response and aerodynamic damping	Damian Vogt University of Stuttgart
3	30 mins	Non-linear aeroelastic interactions in turbine bladed-discs	Roque Corral UPM
4	20 mins	Testing and enhanced predictions of labyrinth seal flutter	Nenad Glodic KTH