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**RECENT ADVANCES IN
APPLIED AND
THEORETICAL
MECHANICS**

**Proceedings of the 5th WSEAS International Conference on
APPLIED and THEORETICAL MECHANICS (MECHANICS '09)**

**Puerto De La Cruz, Tenerife, Canary Islands, Spain,
December 14-16, 2009**



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Preface

This year the 5th WSEAS International Conference on APPLIED and THEORETICAL MECHANICS (MECHANICS '09) was held at Puerto De La Cruz, Tenerife, Canary Islands, Spain, December 14-16, 2009. The conference remains faithful to its original idea of providing a platform to discuss plasticity, fracture, and damage mechanics, mechanics of nanomaterials, fluid-structure interaction, damage identification and non destructive evaluation (NDE), computational and experimental mechanics, geomechanics and mechanics of granular materials, flows in porous media, impact and multibody dynamics, nonlinear dynamics, structural dynamics and control, dynamic instability and buckling, vibrations, acoustics, and noise control, manufacturing processes, advanced materials and smart structures, micro electromechanically systems (MEMS), mechatronics, transport phenomena in micro/nanoscale, aerodynamics and aeroelasticity, computational fluid dynamics (CFD) v turbulence and multiphase flows, biomechanics and biomaterials v surface engineering and contact mechanics, heat and mass transfer, compressible flows etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Boundary Layer Separation Control in Turbomachinery Components: A Short Review and Examples



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Abstract: In the last thirty years many efforts have been done to apply flow control devices inside a real environment in a reliable and efficient way. Even though the concept of boundary layer control was introduced by Prandtl at the beginning of the 20th century only recently it has been thought to “control” the flow inside complex machine such as aeroengine. In particular inside a modern turbomachine the most interesting application of a boundary layer control device is the prevention of flow separation. Boundary layer separation is in fact one of the main causes of total pressure losses, moreover the suppression or delay of separation may allow the introduction of more aerodynamically loaded airfoil and surface. In a modern aero engine this possibility may lead to improvements of the performances of compressors, turbines and diffusing ducts. For this reason, the experimentation of boundary layer separation control methods applied to internal aeroengine flow becomes of primary importance.

Two examples of separating boundary layers are considered:

- laminar boundary layers on a high lift turbine profile;
- turbulent boundary layer on turbine internal ducts.

The strategies for the two cases are different. Laminar separation may be cured simply by enforcing the boundary layer transition by means of a passive device enhancing turbulence production or by means of a synthetic jet.

On the contrary turbulent boundary layer separation control requires a large scale momentum transfer to the wall. That can be accomplished by low profile vortex generators.

Brief Biography of the Speaker:

Laurea in Mechanical Engineering, University of Genova with honours.

Von Karman Institute Diploma Course in Turbomachinery with honours.

Designer of Turbomachinery at Hydroart S.p.A. (Ansaldo, Riva, Tosi), Milano.

Professor of Fluid Machines at the Faculty of Engineering, University of Genova.

Head of the Fluid Machines, Energy Systems and Transportation Department, University of Genova.

Prof. Pietro Zunino is author of more than 100 scientific papers on flow in turbomachines concerning the following research subjects:

- potential flow and boundary layers in turbomachines;
- development of experimental techniques for flow measurements in turbomachines (HW, LDA);
- experimental analysis of turbulence and secondary flows in turbine cascades ;
- experimental analysis of relative flow and turbulence in axial and centrifugal rotors;
- rotor-stator aerodynamic interaction in turbomachines;
- time varying wake flow characteristics and profile boundary layers in turbine cascades;
- unsteady aerodynamics of gas turbine premixing burners;
- boundary layer separation control.

He has been research manager for several research contracts with industries.

He has contributed to several European Research Projects related to the unsteady aerodynamics of aero-engine components.

Prof. Pietro Zunino has been session chairman in International Scientific Conferences.

He has been scientific reviewer for International Conferences and Scientific Journals.

He has been independent evaluator for the European Commission VI and VII Framework, Aeronautical and Space.

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