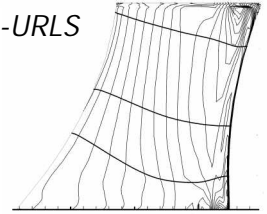


TMRGroup @ DMA-URLS



TurboMachinery Research Group - TMR

Dipartimento di Meccanica e Aeronautica - URLS

Scientific leader

Franco Rispoli, PhD

Associate Professor of Thermal Machines

University of Rome "La Sapienza"

Dipartimento di Meccanica e Aeronautica

via Eudossiana 18, I00184 Roma

ph/fax +39 06 44585233/+39 06 4881759

e-mail rispoli@dma.ing.uniroma1.it, web <http://dma.ing.uniroma1.it>

Franco Rispoli graduated with honour in Mechanical Engineering at the University of Rome La Sapienza in 1981. In the same period he was research associate at the Department for Renewable Energy Sources of CNEN (former Italian National Agency for Nuclear Energy, today ENEA) dealing with aerodynamics and aero-elasticity of wind turbine rotors. In the period 1982 - 1983 he was the winner of two ATI (Italian Thermodynamics Association) fellowships related to internal combustion engine and rational use of energy. In the period 1984 - 1987 he was PhD candidate in energetics at the University of Rome La Sapienza and his research deals with wave propagation methods for the analysis of external combustion engines. Since 1981 he started to work at the Department of Mechanics and Aeronautics - University of Rome La Sapienza, first as research associate then as assistant professor presently as associate professor. He was lecturer of Thermal Machines and Energetic Systems and presently he is in charge for the Internal Combustion Engines course. During his research activity on turbomachinery CFD he has matured significant international experiences: visiting research at the European Center for Scientific and Engineering Computing (IBM), and at the Center for Computing Aids for Industrial Productivity (CAIP) Dept. Of Rutgers State University; visiting professor at Technical University of Budapest. He is also the coordinator of international scientific collaboration with the following Universities: Rice (USA), Delft (Netherlands), Gdansk and Warsaw (Poland), UDEP Piura (Perù) and Budapest (Hungary). He has been the coordinator of several research contracts with the main Italian agencies (MURST, CNR and ENEA). He is author of 55 publications including papers, reports and books related to thermal machines fluid-dynamics, published on national and international journals and/or presented in national and international conferences.

Research activities

Advanced turbulence modeling for Turbomachinery CFD

Two-equations anisotropic models (non linear $k-\epsilon$, explicit algebraic stress models, &c.)

Second Moment Closure

Large Eddy Simulation

Gas turbine combustor modeling

Turbulent reacting flows simulation with finite rate chemistry modeling

Numerical methods for Turbomachinery CFD
 Stabilized Finite Element Methods SUPG/PSPG
 Parallel solver
 Domain Decomposition methods
 Linear and non-linear MultiGrid accelerators

Recent financed researches

- 2001/2003 **State of art tools for the computational benchmarking of complex turbomachinery flows**, MURST (Italian Department for the Academic Research) COFIN01.
- 2000 **Parallel Finite Element Methodology for Turbomachinery CFD**, MURST research contract (ex 40%).
- 1999/2001 **Development of advanced numerical methods for Turbomachinery CFD**, MURST COFIN99.
- 1999/2001 **Investigation on axial flow fans aerodynamic and energetic characteristic for optimized design procedure using concerted experimental-numerical techniques**, Department of Fluid Mechanics - Technical University of Budapest / Dipartimento di Meccanica e Aeronautica University of Rome "La Sapienza".
- 1996/98 **Investigation on flowfield fine structure formed in axial flow fans**, Department of Fluid Mechanics - Technical University of Budapest / Dipartimento di Meccanica e Aeronautica University of Rome "La Sapienza".
- 1995/96 **Numerical investigation of Francis turbine runner flow with Finite Element RANS solver**. MURST contracts 1995/1996.
- 1992/94 **Numerical simulation of turbulent combustion process in Ram-jet engine**, ASI (Italian Space Agency) contract SS n. 150, Dipartimento di Meccanica e Aeronautica University of Rome "La Sapienza".

Relevant international collaboration

- 2001 *Team for Advanced Flow Simulation and Modeling (T*AFSM) - Department of Mechanical Engineering and Materials Science, Rice University of Houston (USA), Prof. T. Tezduyar. Research on:*
- *development of stabilized SUPG/PSPG formulation for unsteady RANS solves;*
 - *development of LES models for turbomachinery flow applications;*
 - *development of adaptive mesh algorithms for flows with moving boundaries and interfaces.*
- 2000 *Thermo-Fluid Section Faculty of Applied Physics Technical University of Delft (Netherland), Prof. K. Hanjalic. Research on:*
- *SMC Elliptic Blending Modeling for compressor cascade flows;*
 - *modeling of transition phenomena in turbomachinery flows.*
- dal 1999 *Warsaw University of Technology (Polonia), Prof. A. Teodorczyk. Research on: turbulent combustion modelling.*
- dal 1999 *Technical University of Gdansk (Polonia), Prof. M. Cichy. Research on: CFD of Internal Combustion Engines.*
- dal 1998 *UDEP – "Universidad Particular de Piura" (Perù), Prof. M. Flores. Research on: I analisi termodinamica di sistemi energetici in condizioni d esercizio deteriorate e metodologie di calcolo 3D per flussi in compressori transonici e supersonici.*
- 1997-00 *Budapest University of Technology and Economics (Hungary), Prof. F. Bencze and Prof. J. Vad. Financed Projects n. I-52/95 e I-28/98 on:*
- *Three-dimensional laser doppler anemometer measurements upstream and downstream of axial flow rotors. Comparison of the measured velocity fields with results provided by three-dimensional turbulent finite element solver;*
 - *Investigation on aerodynamic and energetic characteristics of axial flow fans for the improvement in fan design methodology. A concerted application of laser doppler anemometry and computational fluid dynamics.*
- 1990 *Computer Aids for Industrial Productivity CAIP, Dept. of Rutgers State University (USA), Prof. L. Peskin, Research on: Development of a finite element code for incompressible fluid flow..*
- 1989 *European Center for Scientific and Engineering Computing (IBM) Research on: Finite element commercial code FIDAP parallelization on IBM 3090/VF architecture.*

Staff

- 1 Associate Professor, Thermal Machines
- 1 Associate Professor, Propulsion
- 2 Assistant Professors, Thermal Machines
- 1 Research Assistant, Thermal Machines
- 4 PhD students, Energetics and Energetic and Environment Technologies for Sustainable Development

CFD expertise

In "house" Finite Element code XENIOS (1991) for unsteady 3D incompressible flows. Code version for turbulent flows with standard and anisotropic first order closures, and Reynolds Stress Model. Code version for turbulent reacting flows with finite rate chemistry modelling.

Skill on commercial codes for CFD: FIDAP/FLUENT, PHOENICS.

Skill on commercial codes for structural analysis: NASTRAN, PATRAN.

Hardware&Software expertise

IBM SP2 and SP3, Beowulf PC cluster (in progress), CRAY/T3E 256 procs.

OS: Unix/AIX, Unix/Digital, linux

Relevant scientific publications

1. Corsini A., and Vad J., *Application of forward blade sweep to axial flow industrial fans of high specific performance* . 9th Symp. on Transport Phenomena and Dynamics of Rotating Machinery, ISROMAC9, Honolulu, Hawaii, February 2002.
2. Borello D., Corsini A. e Rispoli F., *A finite element overlapping scheme for turbomachinery flows on parallel platforms* , to be reviewed *Computers & Fluids*, Pergamon Press (n. MS#00-145), November 2001 second submission.
3. Corsini A., Rispoli F. e Vad J., *The role of forward sweep in axial fan rotor aerodynamics* , submitted to (in progress) *Journal of Power and Energy* – Proceedings of the IMechE part A, PBE Ltd, Londra, November 2001.
4. Borello D., Borrelli P., Quagliata E., and Rispoli F., *An hybrid multi-level finite element solver for turbomachinery CFD* , ECCOMAS – CFD 2001, Swansea, UK, September 2001
5. Corsini, A., Rispoli, F., Bencze, F., Vad, J., *Effects of blade sweep in a high performance axial flow rotor* . ATI-CST paper 005/01, in Proc. 4th European Conf. Turbomachinery, Fluid Dynamics and Thermodynamics, Firenze March 2001.
6. Borello D., Corsini A. e Rispoli F., *A finite element domain decomposition method for incompressible turbomachinery flows* , ECCOMAS 2000, Barcelona, September 2000.
7. Borello D., Corsini A. e Rispoli F., *"A parallel approach to FEM modelling of internal, fluid flows"*, Fifth European SGI/Cray MPP Workshop - CINECA, Bologna, September 1999.
8. Corsini, A., Rispoli, F., Bencze, F., Vad, J., *Concerted Experimental and Numerical Studies on Axial Flow Fan Rotor Aerodynamics* . IMechE paper C557/106/99, in Proc. 3rd European Conf. Turbomachinery, Fluid Dynamics and Thermodynamics, pp. 519 – 531, March 1999.
9. Corsini A. e Rispoli F., *"Numerical simulation of three-dimensional viscous flow in an isolated axial rotor"*. *The Archive of Mechanical Engineering (Archiwum budowy maszyn)*, Polska Akademia Nauk, , **XLVI-4**, 369-392 (1999).
10. Borello D., Corsini A. e Rispoli F., *A 3D stabilized finite element technique with compact stiffness matrix treatment. Application to internal flows* . 1997 ASME Fluids Engineering Division Summer Meeting and Fluids Engineering Conference, Vancouver, giugno 1997.
11. Borello D., Corsini A. e Rispoli F., *Prediction of Francis turbine runner performance using a 3D finite element technique with unassembled stiffness matrix treatment* . 2nd European Conference on Turbomachinery - Fluid Dynamics and Thermodynamics, Antwerp, March 1997.
12. Ionta P., Lentini D., Riccucci G., Rispoli F., *"Prediction of Gas Turbine Combustor Flow by a Finite Element Code"*, *I Aerotecnica Missili e Spazio* (international Revision Board), 1995.

13. Ionta P., Lentini D., Rispoli F., "*A Finite Element Code for Gas Turbine Combustor Flow with Stretched Laminar Flamelet Modelling*", AIAA Paper ISABE' 93-7127, Tokyo, July 1993.

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November 2001, DMA-URLS

