Spyros G. Voutsinas

Associate Professor at NTUA, School of Mechanical Engineering, Lab. of Aerodynamics

Degrees: Diploma in Mechanical Engineering (1982, NTUA)
PhD in Unsteady Aerodynamics: "Theoretical and numerical analysis of 3D subsonic flows (1990, NTUA)

Summary of Academic & Research record

Publications: 111 (30 in peer reviewed journals, 76 in peer reviewed conferences, 5 Chapters in collective volumes)

Funded Research Projects: Total number=55
(Project Coordinator in 5, NTUA Responsible in 44, Principal investigator in 6)

Teaching/supervising experience:

Undergraduate courses:	5	Fluid Mechanics, Aircraft design, Aerodynamics, Wind Energy, Aeroelasticity and Aeracoustics
Graduate courses:	3	Mathematical analysis of problems in Fluid Mechanics, Numerical Analysis of Hyperbolic Equations, Wind Turbine Aeroelasticity

Supervision of PhD projects: 12 concluded, 5 in progress

Research interests & expertise:

The main focus of my research activities concerns the theoretical/numerical analysis of coupled problems in aerodynamics with application to wind energy and aeronautics.

In particular research has been directed to:

1. The prediction of unsteady flows around rotors with application to wind turbines, helicopters and tilt-rotor aircraft full configurations exhibiting strong vortex-to-solid interactions,
2. Aeroelastic and aeracoustic analysis of complex aerodynamic configurations (complete wind turbines, helicopters and tilt rotor aircrafts) with emphasis on flow and coupled (flutter) instabilities as well as noise reduction concepts,
3. Optimal design of airfoils and blades for wind turbines,
4. Noise assessment based on noise source evaluation and noise propagation in the atmosphere

Expertise in theoretical/numerical aerodynamics includes dynamics of vortex flows (stability of vortex structures with application to aircraft wake analysis; solid-to-vortex interaction with application to vortex sound and blade-vortex-interaction on helicopters), unsteady boundary layer theory (modelling and prediction of dynamic stall on airfoils),

Expertise in computational aerodynamics includes Vortex Methods applied to wake dynamics, Boundary Element Methods applied to external subsonic flows, Finite Volume Methods applied to viscous 2D and 3D flow simulations, Finite Element Method applied to viscous 2D flows,

Expertise in aerodynamic design concerns the development and application of evolution (genetic) methods in the design of wind turbine blades,

Expertise in structural dynamics and aeroelasticity concerns the development and application of multi-body dynamic analysis; structural and aeroelastic stability; development and application of the Finite Element Method,

Expertise in aeracoustics concerns development and application of noise source estimation on rotors and modelling of propagation in the atmospheric environment.

Research experience:

The majority of my research work has been conducted within the framework of collaborative EU projects financed by the EC in the context of the FP competitive calls, as well as in research projects directly by the industry.

Table of Funded research projects

Topic		Source of Funding		Role	
Wind Energy	40	26	EU, FP*	2 23 1	Project Coordinator NTUA Responsible Principal Investigator
		6	National	2 2 2	Project Coordinator NTUA Responsible Principal Investigator
		10	Industry	10	NTUA Responsible
Aeronautics	8	7	EU, FP*	6 1	NTUA Responsible Pricipal investigator
		-	National	-	-
		1	Industry	1	NTUA Responsible
Other	5	1	EU, FP*	1	NTUA Responsible
		3	National	1 2	Project Coordinator Principal Investigator
		1	Industry	1	NTUA Responsible

Within these projects a close collaboration has been established with major European wind turbine and aircraft/helicopter manufacturers (Enercon, Gamesa, LM, Vestas, Airbus, Eurocopter, AGUSTA-Westlands), European research establishments (CIRA, CENER, CRES, DLR, ECN, ONERA, QuitetiQ, RISOE) and Universities (Carleton U in Canada, DTU in Denmark, U Havre, U Marseilles, Ecole des Mines in France, TU Berlin, U Stuttgart, TU Munchen, U Kasel in Germany, U Roma Tre in Italy and Polytechnico di Milano in Italy, TUDelft in the Netherlands, UPMardid in Spain, KTH and Chalmers U in Sweden, Imperial College, City U. and UMIST in the UK, Mishigan U in USA)

<u>Selected list of selected projects in the field of wind energy</u>

1. "Adaptation of existing wind turbines for operation on high wind speed complex terrain sites; kWh cost reduction" (financed by EU, JOULE3 programme, 1998-2004)
2. "MEGAWIND: Development of a MW scale Wind Turbine for High Wind Complex Terrain Sites" (financed by: EU, ENERGY programme, 2001-2004).
3. "KNOW-BLADE: Wind Turbine Blade Aerodynamics And Aeroelastics Closing Knowledge Gaps" (financed by: EU, GROWTH programme, 2001-2004).
4. "MEXICO: Model Rotor Experiments under Controlled Conditions" (financed by: EU, ENERGY programme, 2001-2005).
5. "5MW Wind Energy Converter For Off-Shore Application" (financed by: EU, ENERGY programme, 2001-2005).
6. "STABCON: Aeroelastic Stability and Control of Large Wind Turbines" (financed by: EU ENERGY programme, 2002-2006)
7. "UPWIND: Finding design solutions for very large wind turbines" (financed by: DGXII-EU FP6, 2006-2011)

Currently there are 10 research projects on Wind Energy, 8 funded by Wind Energy Industries and 2 funded by National Research Funds, 8 on wind turbine aeroelasticity and 2 on off-shore floating wind turbines. NTUA is also participating in the IEA Task 30 dealing with code-to-code comparisons concerning various off-shore wind turbine concepts in the aim of concluding the best practice for the relevant aeroelastic analysis.

Selected Publications:

1. Riziotis, V. A., Manolas, D.,I., Voutsinas S. G., (2011), "Advanced Aeroelastic Modelling of Swept Rotor Blades," Proceedings of the EWEA'11, Brussels, Belgium, March 14 – 17
2. Riziotis, V.A., Voutsinas, S.G., Politis, E.S., Chaviaropoulos, P.K. (2010) "Stability analysis of parked wind turbine blades using a vortex model," Proceedings of the Science of Making Torque from the Wind Conference, Heraklion, Greece, June 28-30, 2010
3. Riziotis, V.A., Voutsinas, S.G., Politis, E.S., Chaviaropoulos, P.K. (2008) "Identification of structural non-linearities due to large deflections on a 5MW wind turbine blade," Proceedings of the EWEC '08, Scientific Track, Brussels, Belgium, March 31 – April 3.
4. Riziotis V.A., Politis E.S., Voutsinas S.G., Chaviaropoulos P.K. Stability analysis of pitch-regulated, variable-speed wind turbines in closed loop operation using a linear eigenvalue approach (2008) Wind Energy, 11 (5), pp. 517-535; citations 4
5. M.O.L Hansen, J.N.Sorensen, S. Voutsinas, N. Sorensen, H.Aa. Madsen (2006) "State of art in wind turbine aerodynamics and aeroelasticity", Int. Rev. J. Progress in Aerospace Sciences, Vol. 42, p.285,330; citations 38
6. S. G. Voutsinas (2006) "Vortex Methods in Aeronautics: How to make things work", Int. Journal of Computational Fluid Dynamics, Vol 20, No 1; citations 7
7. F. Nitze, D. Feszly, D. Waechter, E. Bianchi, S. Voutsinas, M. Gennaretti, G. Coppotelli, G.L. Ghiringhelli (2005) "The SHARCS project: Small hybrid active rotor control system for noise and vibration attenuation of helicopter rotor blades", 31st European Rotorcraft Forum, Florence, Italy; citations 4
8. V. Riziotis, S.G. Voutsinas, E.S. Politis, P.K. Chaviaropoulos (2004) "Aeroelastic Stability of Wind Turbines: the problem, the methods, the issues", Wind Energy, V. 7, p 373-392; citations 18
9. P. K. Chaviaropoulos, I. G. Nikolaou, K. A. Aggelis, N. N. Soerensen, J. Johansen, M. O. L. Hansen, Mac Gaunaa, T. Hambraus, Heiko Frhr. von Geyr, Ch. Hirsch, Kang Shun, S. G. Voutsinas, G. Tzabiras, Y. Perivolaris, S. Z. Dyrmose (2003) "Viscous and Aeroelastic Effects on Wind Turbine Blades. The VISCEL project. Part I: 3D Navier-Stokes Rotor simulations" Wind Energy, 6, p 365-385, citations 13
10. P. K. Chaviaropoulos, I. G. Nikolaou, K. A. Aggelis, N. N. Soerensen, J. Johansen, M. O. L. Hansen, Mac Gaunaa, T. Hambraus, Heiko Frhr. von Geyr, Ch. Hirsch, Kang Shun, S. G. Voutsinas, G. Tzabiras, Y. Perivolaris, S. Z. Dyrmose (2003) "Viscous and Aeroelastic Effects on Wind Turbine Blades. The VISCEL project. Part II: Aeroelastic Stability Investigations", 6, p 387-403 citations 7

Chapters in collective volumes:

4 chapters in "Wind Turbine Aerodynamics: a state-of-the-art," Ed J.F. Brouckaert, VKI Lecture Series 2007-05, ISBN 13 978-2-930389-75-3

Chapter 7: Structural modeling and dynamics, Voutsinas, S, Riziotis, V
Chapter 8: Aeroelastic Modeling of Wind Turbines, Voutsinas, S, Riziotis, V
Chapter 9: Stability Ananlysis & Control, Voutsinas, S, Riziotis, V
Chapter 10: Certification of Wind Turbines, Voutsinas, S, Riziotis, V

1 chapter in "Wind Power Generation and Wind Turbine Design", Ed Wei Tong, WIT Press, 2010

Chapter 4: Structural dynamics of Wind Turbines, Voutsinas, S.

Invited presentations to international post graduate courses:
"Wind Turbine Aerodynamics: A state of the art", Von Karman Institute, March 19-23, 2007

Organisation of international conferences:
"TORQUE 2010: The Science of Making Torque from Wind", 3rd EAWE Scientific Conference on Wind Energy, Crete, June 2010

Editor ships:

Associate Editor in ASME's Journal of Solar Energy and Engineering responsible for Wind Energy (2007-2011)

Associate Editor in Wind Energy, (2012-)