Simone ZUCCHER

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Education
- January 2002: Ph.D in Aerospace Engineering, Politecnico di Milano, Milano, Italy. Dissertation: Receptivity and Control of Flow Instabilities in a Boundary Layer.
- June 1999: *Diploma Course*, von Kármán Institute for Fluid Dynamics (VKI), Bruxelles, Belgium. **Graduation with honors and recipient of VKI prize 1998-1999**. Project title: Liquid Film Instabilities of Wire Coatings.
- December 1997: M.S. in Aerospace Engineering (Five-year degree, Master of Science equivalent), Politecnico di Milano, Milano, Italy. **100/100, *Magna cum laude***. Project title: Post-Stall Chaotic Motions.

Positions Held
- November 2005 – present: Research Associate, University of Verona, Verona, Italy.
- September 2004 – August 2005: Research Assistant Professor, University of Arizona, Tucson, AZ, USA.
- February 2004 – June 2004: Research Associate, Politecnico di Milano, Italy.
- February 2002 – January 2004: Faculty Research Associate, Arizona State University, Tempe, AZ, USA.

Research Interests
- General area of fluid mechanics (classical and non-classical) and applied mathematics with emphasis on fluid-dynamic instabilities. Theoretical, numerical and experimental aspects of transition from laminar to turbulent flows, turbulence, optimal and robust control applied to fluid mechanics, premixed laminar combustion, optimization techniques, possible chaotic behaviors in flight mechanics, mathematical biology.

Research Experience
- November 2005 - present: Research Associate at the Department of Computer Science, University of Verona, Italy.
  - Development of Fortran and Octave codes for the numerical solution of a generalization of Madelung-fluid equations by employing spectral methods (bivariate Hermite polynomials) over an infinite domain.
  - Preliminary development and implementation of a Fortran code for the study of premixed laminar flames by employing the equations of fluid mechanics and chemistry (in collaboration with the R&D Department of Riello Burners, Verona, Italy).

- September 2004 – August 2005: Research Assistant Professor at Aerospace and Mechanical Engineering Department, University of Arizona, Tucson, AZ, USA.
  - Theoretical and numerical studies of laminar-to-turbulent boundary layer transition induced by the transient growth instability in compressible and supersonic flows.
  - Solution of constrained optimization problems via adjoint-based methods applied in the discrete framework.
  - Development and implementation of a Fortran code with related documentation for the investigation of transient growth instability in compressible boundary layers at supersonic speed for different geometries (flat plate, cone, sphere, etc.).

- February 2004 – June 2004: Research Associate at Aerospace Engineering Department, Politecnico di Milano, Italy.
  - Study of the impulse response of a turbulent channel flow via Direct Numerical Simulation (DNS) using the cross-correlation between a white noise input signal and its corresponding output.
  - Statistical description of the impulse response in both physical and Fourier space, so as to improve the design of a possible flow controller.

Research Experience (continues)	• February 2002 – January 2004: Faculty Research Associate at Mechanical and Aerospace Engineering Department, Arizona State University, Tempe, AZ, USA. – Experiments and computations on boundary layer transition in low speed (5-30 m/s) and supersonic (Mach number 2.4) flows. – Hotwire, hotfilm and infrared thermography measurements. – Development of a real-time code, based on LabVIEW I/O integration, to run and control the supersonic wind tunnel at Arizona State University. – Flow-quality tests in incompressible flows (freestream measurements and data analysis). – Development and implementation of a post-processing procedure for the sound-turbulence separation, based on two time histories from hotwires. – Implementation of a numerical code (in Fortran) for the solution of the three dimensional, incompressible, nonlinear parabolized stability equations. • November 1998 – January 2002: Ph.D candidate at Aerospace Engineering Department, Politecnico di Milano, Milano, Italy. – Theoretical and numerical investigations on boundary layer transition in incompressible flows. – Study of boundary-layer receptivity to the mutual interactions between acoustic and vorticity waves, wall roughness, and wall vibration. – Application of perturbation methods and introduction of the inhomogeneous multiple-scale approach for boundary-layer receptivity problems. – Development and implementation of a code to investigate the three-dimensional, algebraically growing instability of a Blasius boundary layer in the nonlinear regime. – Adjoint-based optimization techniques applied to fluid dynamic problems with emphasis on optimal and robust control. • October 1998 – June 1999: *Diploma Course*, graduate student at von Kármán Institute for Fluid Dynamics, Bruxelles, Belgium. – Theoretical and experimental investigations of fluid-dynamic instabilities occurring during the wire coating process. – Development and construction of a new measurement apparatus, based on the use of a laser sheet, to detect wave characteristics. Implementation of the appropriate post-processing technique to retrieve them. – Different coating techniques widely investigated: *simple withdrawal* , *die coating* and *annular jet wiping*. • February 1998 – May 1998: Training Stage at Aermacchi S.p.A, Department of Aerodynamics, Venegono Inferiore, Varese, Italy. – Integration of experimental data from wind-tunnel tests with data from numerical simulations (CFD). – Development, validation and documentation of a mathematical model for determining the aerodynamic loads of the military trainer AEM/YAK-130. • September 1992 – December 1997: Undergraduate student at Aerospace Engineering Department, Politecnico di Milano, Milano, Italy. The final project includes: – Theoretical and experimental study of the spin of a fighter aircraft. – Design and construction of a wind-tunnel model with abrupt leading edge stall. – Wind-tunnel tests on the model attached to its center of gravity through an universal joint that allows only the three rotations. – Data (three angles as a function of time) analysis using the typical tools of chaos theory (spectra, phase space, embedding space and Poincaré sections).

Contracs, Fellowships and Grants	• December 2010 – November 2011: research contract with the University of Verona, Italy, on implementation of numerical algorithms for the simulation of quantum turbulence. • December 2009 – November 2010: research contract with the University of Verona, Italy, on numerical simulations of problems governed by nonlinear Schröedinger equations. • October 2008 – September 2009: research contract with the University of Verona, Italy, on numerical simulations of problems governed by nonlinear Schröedinger equations. • November 2005 – June 2006: research contract with the University of Verona, Italy, on numerical simulations of problems governed by partial differential equations. • September 2004 – August 2005: research contract with the University of Arizona, AZ, USA, on stability of compressible boundary layers. • March 2004 – June 2005: research contract with Politecnico di Milano, Italy, on numerical simulations of turbulence. • February 2002 – January 2004: research contract with Arizona State University, AZ, USA, on laminar-to-turbulence boundary-layer transition in incompressible and compressible flows. • January 2001 – July 2001: fellowship awarded by the European Community in the framework of Marie Curie Fellowship for a stage period at IMFT (Institut de Mécanique des Fluides de Toulouse). • November 1998 – October 2001: post–graduate grant awarded by CIRA (Centro Italiano Ricerche Aerospaziali) for the PhD studies. • April 2001: grant awarded by Lulea University of Technology for participating to the 4th SIG 33 Workshop *Flow Control*. • October 1998 – June 1999: fellowship awarded by von Kármán Institute for Fluid Dynamics for the *Diploma Course* at VKI. • September 1999: grant awarded by CISM (Centro Internazionale Scienze Meccaniche), for participating to the Advanced School *Turbulence, Modulation and Control*. • September 1998: grant awarded by Centro Volta for participating to the Summer School *Turbulence: Theoretical Concepts and Industrial Applications*.
Teaching Experience	• March 2010 – June 2010: lectures of "Fluid Dynamics", Department of Computer Science, University of Verona, Italy. • April 2009 – June 2009: numerical lab and contributions to the lectures of "Fluid Dynamics", Department of Computer Science, University of Verona, Italy. • April 2008 – June 2008: numerical lab and contributions to the lectures of "Mathematical Models for Biology", Department of Computer Science, University of Verona, Italy. • April 2007 – June 2007: numerical lab and contributions to the lectures of "Mathematical Models for Biology", Department of Computer Science, University of Verona, Italy. • October 2007 – March 2008: contributions to the lectures of "Mathematical Analysis", Department of Computer Science, University of Verona, Italy. • October 2006 – March 2007: contributions to the lectures of "Mathematical Analysis", Department of Computer Science, University of Verona, Italy. • September 2004 – August 2005: contributions to the lectures of "Numerical Methods" (AME-302), Aerospace and Mechanical Engineering Department, University of Arizona, Tucson, AZ, USA. • February 2002 – January 2004: contributions to the lectures of "Gas Dynamics" (MAE-460), Mechanical and Aerospace Engineering Department, Arizona State University, Tempe, AZ, USA. • February 2002 – January 2004: contributions to the lectures of "Computational Fluid Dynamics" (MAE-561, for graduate students), Mechanical and Aerospace Engineering Department, Arizona State University, Tempe, AZ, USA. • March 1998 – June 1998: contributions to the lectures of "Heat Transfer and Thermodynamics", Aerospace Engineering Department, Politecnico di Milano, Milano, Italy. • July 2001 – present: permanent teacher of Mathematics and Physics in Italian high school.

Activity of Scientific Coordination	• February 2002 – January 2004: coordinator of the experimental activity carried out at the Supersonic Wind Tunnel ($M = 2.4$) and at the Unsteady Wind Tunnel (a low-speed wind tunnel) of the Arizona State University, Tempe, AZ, USA.
Organization of Scientific Events	• Part of the local organizing committee for the workshop *Mathematical Models of Quantum Fluids: Geometrical, Analytical and Computational Aspects*, Verona (Italy), September 14–17 2009.
Reviewing Activity	• AIAA Journal. • European Journal of Mechanics – B/Fluids. • Experiments in Fluids. • International Journal of Numerical Methods for Heat and Fluid Flow. • International Journal of Heat and Mass Transfer. • Journal of Computational Physics.
Co-authors and Past/Present Scientific Collaborations (in alphabetic order)	• Prof. Carlo F. Barenghi, Newcastle University, UK. • Prof. Alessandro Bottaro, Università di Genova, Italia. • Dr. Marco Caliari, Università di Verona, Italy. • Prof. Sergio De Ponte, Politecnico di Milano, Italy. • Prof. Paolo Luchini, Università di Salerno, Italy. • Prof. Laura Maria Morato, Università di Verona, Italy. • Prof. Maurizio Quadrio, Politecnico di Milano, Italy. • Prof. Helen Reed, Texas A&M University, College Station, TX, USA. • Prof. Eli Reshotko, Kent H. Smith Professor Emeritus of Engineering, Case Western Reserve University, Cleveland, OH, USA. • Prof. William S. Saric, Distinguished Professor Stewart & Stevenson Professor, Texas A&M University Flight Research Laboratory Director, College Station, TX, USA. • Prof. Marco Squassina, Università di Verona, Italy. • Prof. Anatoli Tumin, University of Arizona, Tucson, AZ, USA.
Society Membership	• American Physical Society (APS). • American Institute of Aeronautics and Astronautics (AIAA).
Awards	• June 1999: "1998-1999 von Kármán Prize" as the best student among those from the top Universities in Europe, USA and Canada. The citation reads "*The von Kármán Prize is awarded each year to the graduate of the VKI Diploma Course who has achieved the best overall result in his or her course work and research project*".
Languages	• Italian: mother tongue. • English: excellent knowledge. • Spanish: scholastic knowledge. • French: scholastic knowledge.
Computer Skills	• Operating Systems: Linux, UNIX, Windows, DOS. • Programming Languages: Fortran, C, Pascal, CPL. • Environments: LabView, Matlab, Octave.
Other Certifications	• May 1998: Certified with the "Qualification to the profession of engineer", Italy. • July 2001: Certified as "Permanent Teacher" of mathematics and physics in Italian high schools.
Personal Data	• Date of birth: March 22, 1973. • Nationality: Italian. • Sex: male. • Status: single.

Publications

Books	• Squassina, M. & Zuccher, S. 2008. *Introduzione all'Analisi Qualitativa delle Equazioni Differenziali Ordinarie*, Apogeo, Feltrinelli Editore.

Journal Papers	• Zuccher, S. 2009. An experimental study of the liquid film on a vertical wire under the action of an impinging annular jet, *Experiments in Fluids*, **46**, 2, 309–322.
	• Caliari, M., Loffredo, M. I., Morato L. M. & Zuccher, S. 2008. Cubic Nonlinear Schödinger Equation with vorticity. *New Journal of Physics*, **10**, 123020.
	• Zuccher, S. 2008. Experimental investigations of the liquid-film instabilities forming on a wire under the action of a die, *International Journal of Heat and Fluid Flow*, **29**, 6, 1586–1592.
	• Squassina, M. & Zuccher, S. 2008. Numerical computations for the spatial segregation limit of some 2D competition-diffusion systems, *Advances in Mathematical Sciences and Applications*, **18**, No. 1, 83–104.
	• Zuccher, S. & Saric, W. 2008. Infrared Thermography Investigations in Transitional Supersonic Boundary Layers, *Experiments in Fluids*, **44**, 1, 145–157.
	• Zuccher, S. & De Ponte, S. 2007. Post-Stall Motions Evolving Toward Chaos, *Journal of Aircraft*, **44**, No. 3, 833-844.
	• Zuccher, S., Shalaev, I., Tumin, A. & Reshotko, E. 2007. Optimal Disturbances in the Supersonic Boundary Layer Past a Sharp Cone. *AIAA Journal*, **45**, No. 2, 366–373.
	• Luchini, P., Quadrio, M. & Zuccher, S. 2006. The phase-locked mean impulse response of a turbulent channel flow. *Physics of Fluids*, **18**, 121702.
	• Zuccher, S., Tumin, A. & Reshotko E. 2006. Parabolic Approach to Optimal Perturbations in Compressible Boundary Layers, *Journal of Fluid Mechanics* **556**, 189–216.
	• Zuccher, S., Bottaro A., & Luchini, P. 2006. Algebraic Growth in a Blasius Boundary Layer: Nonlinear Optimal Disturbances, *European Journal of Mechanics B* **25**, 1 –17
	• Zuccher, S. 2005. A Novel Measurement Technique for the Study of Wire Coating Instabilities, *Experiments in Fluids*, **39**, 4, 694–702.
	• Zuccher, S., Luchini, P. & Bottaro A. 2004. Algebraic Growth of Blasius Boundary Layer: Optimal and Robust Control in the Nonlinear Regime, *Journal of Fluid Mechanics* **513**, 135–160.

Contributed Papers	• Zuccher, S., Shalaev, I., Tumin, A. & Reshotko E. 2006. Optimal Disturbances in the Supersonic Boundary Layer Past a Sharp Cone, *AIAA Paper 2006-1113*.
	• Zuccher, S., Tumin, A. & Reshotko E. 2005. Optimal Disturbances in Compressible Boundary Layers – Complete Energy Norm Analysis, *AIAA Paper 2005-5314*.
	• Zuccher, S., Luchini, P. & Bottaro A. 2004. Nonlinear Optimal Disturbances in a Blasius Boundary Layer and their Control. In: *Hydrodynamic Stability and Flow Control*, ed.: P.J. Schmid, SIAM, Philadelphia, USA.
	• Zuccher, S., Saric, W., Reed H. & McNeil, L. 2003. The Role of Infrared Thermography in the Study of Crossflow Instability at M=2.4. In *Proceedings of the 7th Triennial International Symposium on Fluid Control, Measurement and Visualization*. Sorrento, Italy.
	• Zuccher, S. & Luchini, P. 2002. Time-Dependent Optimal Perturbations for the Algebraic Instability in the Nonlinear Regime. In *Proceedings of the 2002 ASME Fluids Engineering Division Summer Meeting*. Montreal, Quebec, Canada.
	• Zuccher, S. & Buchlin, J.–M. 2001. Liquid Film Instabilities in Die Coating Process. In *Advances in Coating Processes*. Proceedings of 4th European Coating Symposium 2001, Free University of Brussels, Belgium
	• Buchlin, J.–M. & Zuccher, S. 1999. Liquid Film Instability of Wire Coating. In *Advances in Coating and Drying of Thin Films*. Proceedings of 3rd European Coating Symposium 1999. University of Erlangen–Nürnberg, Germany

Conference Presentations	• Luchini, P., Quadrio, M. & Zuccher, S. *Phase-Locked Linear Response of a Turbulent Channel Flow*, ERCOFTAC European Drag Reduction and Flow Control Meeting, 10–13 April, 2006, Ischia, Italy.
	• Zuccher, S., Shalaev, I., Tumin, A. & Reshotko E. *Optimal Disturbances in the Supersonic Boundary Layer Past a Sharp Cone*, 44th AIAA Aerospace Sciences Meeting and Exhibit, 9–12 January, 2006, Reno, NV, USA.
	• Zuccher, S., Tumin A., & Reshotko, E. *Optimal Disturbances in Compressible Boundary Layers. Complete Energy Norm Analysis*, 4th AIAA Theoretical Fluid Mechanics Meeting, 6–9 June, 2005, Toronto, Ontario, Canada.
	• Zuccher, S., Saric, W., Reed H. McNeil, L. & Mönttinen, J. *Transition Detection in Supersonic, Swept-Wing Flows.* 56th Annual Meeting of American Physical Society, Division of Fluid Dynamics, November 23–25, 2003, New Jersey, NJ, USA.
	• Zuccher, S., Saric, W., Reed H. & McNeil, L. *The Role of Infrared Thermography in the Study of Crossflow Instability at M=2.4.* 7th Triennial International Symposium on Fluid Control, Measurement and Visualization. Sorrento, Italy.
	• Zuccher, S., Luchini, P. & Bottaro A. *Nonlinear Optimal Disturbances in a Blasius Boundary Layer and their Control*, Joint Summer Research Conferences AMS, IMS, SIAM, Hydrodynamic Stability and Flow Control, July 6–10, 2003, Utah, USA.
	• Zuccher, S., McNeil, L., Bennett, E., Saric, W. & Reed, H. *Experiments on Laminar Flow Control at Mach 2.4 using Distributed Roughness*, 55th Annual Meeting of American Physical Society, Division of Fluid Dynamics, November 24–26, 2002, Dallas, TX, USA
	• Zuccher, S. & Luchini, P. 2002 *Time-Dependent Optimal Perturbations for the Algebraic Instability in the Nonlinear Regime.* 2002 ASME Fluids Engineering Division Summer Meeting. Montreal, Quebec, Canada
	• Zuccher, S., Luchini, P. & Bottaro A. *Optimal Perturbations and Control of Nonlinear Boundary Layers*, 54th Annual Meeting of American Physical Society, Division of Fluid Dynamics, November 18–20, 2001, San Diego, CA, USA
	• Zuccher, S. & Buchlin, J.–M. 2001 *Liquid Film Instabilities in Die Coating Process.* 4th European Coating Symposium 2001 – *Advances in Coating Processes*, Free University of Brussels, Belgium
	• Zuccher, S. & Luchini, P. *Boundary Layer Receptivity to Acoustic Waves Interacting with Wall Roughness*, 3rd ERCOFTAC SIG 33 Workshop – *New and Emerging Techniques for Transition Prediction*, April 27–28, 2000, Ravello, Italy
	• Buchlin, J.–M. & Zuccher, S. *Liquid Film Instability of Wire Coating*, 3rd European Coating Symposium 1999 – *Advances in Coating and Drying of Thin Films*, University of Erlangen–Nürnberg, September 7–10, 1999, Erlangen, Germany
	• Zuccher, S. *Post–Stall Chaotic Motions*, Summer School – *Turbulence: Theoretical Concepts and Industrial Applications*, September 7–12, 1998, Como, Italy
Invited Seminars	• Zuccher, S. 2007 *Numerical simulation of spatial-segregation phenomena for some competition-diffusion systems*, Department of Computer Science, University of Verona, Italy.
	• Zuccher, S. 2007 *Fluid dynamics: what it is, what is used for and its connection to applied mathematics*, Department of Computer Science, University of Verona, Italy.
	• Zuccher, S. 2005 *Adjoint-based optimization for the study of transition and its control*, Aerospace and Mechanical Engineering Department, University of Arizona, Tucson, US.
	• Zuccher, S. 2005 *Transiently growing disturbances and their control in boundary layers*, ETSEQ, Universitat Rovira i Virgili, Tarragona, Spain.
	• Zuccher, S. 2004 *An adjoint optimization technique for the study of nonlinear optimal disturbances and their control*, ETSIA, Universidad Politecnica de Madrid, Spain.

Theses	• Zuccher, S. 2002 *Receptivity and Control of Flow Instabilities in a Boundary Layer*, Ph.D Thesis, Politecnico di Milano, Milano. • Zuccher, S. 1999 *Liquid Film Instabilities of Wire Coatings*, Final Report, von Kármán Institute for Fluid Dynamics, Rhode–Saint–Genèse. • Zuccher, S. 1997 *Moti Caotici Post–Stallo*, Graduation Thesis, Politecnico di Milano, Milano.
Technical Reports and Miscellanea	• Burato, A., Chignola, R., Castelli, F., Corso, L., Pezzo, G., Zuccher, S. 2007 *Matematica e radioterapia dei tumori. Sviluppo e applicazioni di un modello predittivo semplificato*, I quaderni del Marconi – Quaderni didattici, Verona, Italy. • Zuccher, S., Caliari, M., Argentini, G., De Marchi, S. 2006 *A study on premixed laminar flames*, Dipartimento di Informatica, Rapporto di ricerca 46, Verona, Italy. • Chignola, R., Castelli, F., Corso, L., Pezzo, G., Zuccher, S. 2006 *La biomatematica in un problema di oncologia sperimentale*, I quaderni del Marconi – Quaderni didattici, Verona, Italy. • Zuccher, S. 2006 *Una proposta di discretizzazione dell'equazione di Gompertz*, MatematicaMente, No.103, Maggio 2006, Verona, Italy. • Zuccher, S. & Luchini, P. 2004 *Boundary-Layer Receptivity to External Disturbances Using Multiple Scales*, DIA-SR 04-01, Politecnico di Milano, Milano, Italy. • Hanifi, A., Pralits, J. O., Zuccher, S, Donelli, R. & Airiau, C. 2001 *Adjoint-based Sensitivity Analysis: Validation and Comparison.* Technical Report TR 22, ALTTA Deliverable No D3.1.4-2.

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