

Silvia Ravelli Curriculum Vitae

Born in 1978

EDUCATION

- 1993-1997 High school degree of Scientific studies, 60/60.
- 1998-2002 Master of Science in Engineering Degree, 110/110 *cum laude*, University of Bergamo, Italy, Faculty of Engineering. Degree class: Industrial Engineering. Thesis title: "Structure and analysis of intermediate chemical trade".
- 2003-2006: PhD in "Energy and Environmental Technologies" at University of Bergamo, Italy, Faculty of Engineering. Dissertation title: "Waste-to-energy plant modelling: detailed analysis of the fluidized bed combustor".

ACADEMIC CARRIER

2006-2007: Fellowship as research assistant at the Department of Industrial Engineering - University of Bergamo.

01/02/2008-31/05/2017: Assistant Professor in Energy Systems at the Department of Engineering and Applied Sciences - University of Bergamo. In February 2011 she got tenure.

Since June 2017 she is Associate Professor in Energy Systems at the Department of Engineering and Applied Sciences - University of Bergamo.

TEACHING ACTIVITIES

Since 2003, she has been involved in teaching Energy Systems and Turbomachinery at Mechanical Engineering Course of Bergamo University. Between 2008 and 2010 she was responsible of teaching "Energy conversion systems" at Management Engineering Course of Bergamo University - First level degree. Since 2010 she has been teaching "Advanced energy systems" at Mechanical Engineering Course of Bergamo University - Second Level Degree.

WORK EXPERIENCE

In 2006 she worked in Centro Sviluppo Materiali S.p.A., a R&D centre in Dalmine, Italy, within a project on CFD modelling of industrial furnaces for thermal treatment of steel tubes.

RESEARCH ABROAD

In 2009 visiting scholar at the University of Texas at Austin, Department of Mechanical Engineering, within a project, led by Prof. D. G. Bogard, on cooling of the turbine section in gas turbine engines.

EXPERTISE

- Modelling and optimization of conventional and advanced power plants (co-production of electric and thermal power, district heating) fed by fossil and alternative fuels.

Codes: Thermoflow Inc. - Thermoflex, Thermoflow *ELINK*, Matlab

- CFD modelling using commercial and open source codes:
 - film cooling of the turbine section in gas turbine engines;
 - numerical validation of aerodynamic and thermal performance of high pressure turbines in gas turbine engines;
 - combustion processes: methane combustion in flameless vs. conventional burners, refuse derived fuel combustion in bubbling fluidized bed furnaces.

Solver: ANSYS FLUENT & CFX, STARCCM+; Grid generation: GAMBIT, Pointwise; Visualization: Tecplot, Enight; ongoing training in OpenFoam

- Basic knowledge of experimental investigation of film cooling in flat plate and turbine vane/blade cascade in a linear arrangement.

AWARDS and HONOURS

Member of the American Society of Mechanical Engineers (ASME) since 2009.

2014 Best Paper Award from the Heat Transfer Committee of the ASME-International Gas Turbine Institute - paper title "Application of Unsteady CFD Methods to Trailing Edge Cuback Film Cooling" by S. Ravelli and G. Barigozzi

List of publications

- [1] **S. Ravelli**, A. Perdichizzi, G. Barigozzi, "Confronto fra tecnologie per la termovalorizzazione: forno a letto fluido e forno a griglia", 60° Congresso Nazionale ATI, 13-15 settembre 2005, Roma.
- [2] **S. Ravelli**, A. Perdichizzi, "Numerical modelling of a bubbling fluidized bed combustor", Waste Management 2006, June 21-23, 2006, Malta, *published on WIT Transactions on Ecology and the Environment 92*, pp. 469-478.
- [3] **S. Ravelli**, A. Perdichizzi, "Energy from RDF by means of fluidized bed combustion", Venice 2006, Biomass and Waste to Energy Symposium, 29 November to 1 December 2006, Cini Foundation.
- [4] G. Barigozzi, G. Franchini, A. Perdichizzi, **S. Ravelli**, "Area ratio effects on flat plate film cooling through shaped holes", 62° Congresso Nazionale ATI, 11-14 settembre 2007, Università di Salerno.
- [5] E. Malfa, U. Zanusso, L. Ballarino, M. Fantuzzi, **S. Ravelli**, A. Savioli, "Revamping of treatment furnace with Tenova Flexytech® TLX burners", 7th High Temperature Air Combustion and Gasification International Symposium, January 13-16, 2008, Phuket, Thailand & XXXI Combustion Meeting, June 17-20, 2008, Torino, Italy.
- [6] G. Barigozzi, A. Perdichizzi, **S. Ravelli**, "Analisi del campo di moto a valle di un ventilatore a flusso misto per il raffreddamento del sottocofano di trattori", MIS-MAC 2008, 28 marzo 2008, Napoli.
- [7] **S. Ravelli**, A. Perdichizzi, G. Barigozzi, "Description, application and numerical modelling of bubbling fluidized bed combustion in waste-to-energy plants", *Progress in Energy and Combustion Science* 2008; 34:224–253.
- [8] G. Barigozzi, G. Franchini, A. Perdichizzi, **S. Ravelli**, "Contouring effects on the adiabatic effectiveness distribution over a film cooled endwall cascade", 8th European Turbomachinery Conference, March 23-27, 2009, Graz, Austria.
- [9] G. Barigozzi, G. Franchini, A. Perdichizzi and **S. Ravelli**, "Experimental Analysis of the Combining Effects of Endwall Contouring and Film Cooling through Shaped Holes", 9th International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows (ISAI9), September 8-11, 2009, Gyeongju, Korea.
- [10] G. Barigozzi, G. Franchini, A. Perdichizzi, **S. Ravelli**, "Effects of Trenched Holes on Film Cooling of A Contoured Endwall Nozzle Vane", ASME Paper GT2010-22117, *published on J. Turbomach* 2012, 134/041009-1:10.
- [11] L. D. Dobrowolski, D. G. Bogard, **S. Ravelli**, "Accuracy of Conventional Adiabatic Effectiveness and Heat Transfer Augmentation Factors in Predicting Heat Flux into a Turbine Blade Leading Edge", ASME Paper GT2010-23438.
- [12] **S. Ravelli**, L. D. Dobrowolski, D. G. Bogard, "Evaluating the Effects of Internal Impingement Cooling on a Film Cooled Turbine Blade Leading Edge", ASME paper GT2010-23002.
- [13] G. Barigozzi, G. Franchini, A. Perdichizzi, **S. Ravelli**, "Film cooling of a contoured endwall nozzle vane through fan-shaped holes", *Int. J. of Heat and Fluid Flow* 2010; 31:576–585.
- [14] G. Barigozzi, **S. Ravelli**, M. Miranda, "Aerodynamic Investigation of Trailing Edge Film Cooling in a Linear Gas Turbine Nozzle Vane Cascade", 65° Congresso Nazionale ATI, 13-17 settembre 2010, Domus de Maria (CA).
- [15] G. Barigozzi, A. Perdichizzi, **S. Ravelli**, "Wet and dry cooling systems optimization applied to a modern waste-to-energy cogeneration heat and power plant", *Applied Energy* 2011, 88:1366-76.
- [16] G. Barigozzi, **S. Ravelli**, Effects of trailing edge film cooling on the aerodynamic performance of a nozzle vane cascade, 9th European Turbomachinery Conference, March 21-25, 2011, Istanbul, Turkey.
- [17] G. Barigozzi, A. Perdichizzi, **S. Ravelli**, "Pressure Side and Cutback Trailing Edge Film Cooling in a Linear Nozzle Vane Cascade at Different Mach Numbers", ASME Paper GT2011-45898, *published on J. Turbomach* 2012, 134/051037-1:10.

- [18] S. Mathew, **S. Ravelli**, D. G. Bogard, "Evaluation of CFD predictions using thermal field measurements on a simulated film cooled turbine blade leading edge", ASME paper GT2011-46619, *published on J. Turbomach* 2013, 135/ 011021-1:10.
- [19] G. Barigozzi, **S. Ravelli**, "The Effect of Turbulence Models on CFD Predictions of the Flowfield in a Turbine Nozzle Vane Cascade", 10th International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows (ISAI10), July 4-7, 2011, Brussels, Belgium.
- [20] G. Barigozzi, G. Bonetti, G. Franchini, A. Perdichizzi and **S. Ravelli**, "Thermal performance prediction of a solar hybrid gas turbine", *Solar Energy* 2012, 86:2116–27.
- [21] G. Barigozzi, **S. Ravelli**, M. Maritano, R. Abram, "Computational predictions of aero-thermal performance of a turbine filleted blade cascade with endwall film cooling", ASME paper GT2012-69049.
- [22] G. Barigozzi, G. Bonetti, G. Franchini, A. Perdichizzi and **S. Ravelli**, "Solar hybrid combined cycle performance prediction: influence of GT model and spool arrangement", ASME Paper GT2012-68881, *published on J. of Engineering for Gas Turbines and Power* 2012, 134/121701-1:11.
- [23] G. Barigozzi, M. Miranda, **S. Ravelli**, "Preliminary steady-state heat transfer results on the trailing edge cutback of a high pressure gas turbine vane", 67° Congresso Nazionale ATI, 11-14 settembre 2012, Trieste.
- [24] **S. Ravelli**, M. Miranda, G. Barigozzi, "Steady CFD simulations of trailing edge film cooling in a linear nozzle vane cascade", 10th European Turbomachinery Conference, April 15-19, 2013, Lappeenranta, Finland.
- [25] G. Barigozzi, **S. Ravelli**, A. Armellini, C. Mucignat, L. Casarsa, "Experimental Investigation of unsteadiness associated with film cooling flow ejection from the vane pressure side", 10th European Turbomachinery Conference, April 15-19, 2013, Lappeenranta, Finland.
- [26] **S. Ravelli**, G. Barigozzi, "Evaluation of RANS Predictions on a Linear Nozzle Vane Cascade With Trailing Edge Cutback Film Cooling", ASME Paper GT2013-94694.
- [27] G. Franchini, A. Perdichizzi, G. Barigozzi, **S. Ravelli**, "Simulation of Solarized Combined Cycles: Comparison Between Hybrid GT and ISCC Plants", ASME Paper GT2013-95483, *published on J. of Engineering for Gas Turbines and Power* 2014, 136/ 031701-1:10.
- [28] G. Barigozzi, **S. Ravelli**, A. Armellini, C. Mucignat, L. Casarsa, "Effects of injection conditions and Mach number on unsteadiness arising within coolant jets over a pressure side vane surface", *I. J. of Heat and Mass Transfer* 2013, 67:1220–1230.
- [29] G. Barigozzi, G. Franchini, A. Perdichizzi, **S. Ravelli**, "Performance prediction of CSP conventional steam plants and hybrid combined cycles", International Conference on Renewable Energy and its Future in the Arab World - ICREFAW Conference 2013, 22-24 April, Amman Jordan.
- [30] G. Franchini, A. Perdichizzi, **S. Ravelli**, G. Barigozzi, "A comparative study between parabolic trough and solar tower technologies in Solar Rankine Cycle and Integrated Solar Combined Cycle plants", *Solar Energy* 2013, 98:302–314.
- [31] **S. Ravelli**, G. Barigozzi, R. Ponzini, "Cooling of the turbine section in gas turbine engines: combined experimental and numerical modeling using HPC infrastructure", International CAE Conference 2013, October 21-22, 2013, Pacengo del Garda, Verona, Italy.
- [32] A. Perdichizzi, G. Barigozzi, G. Franchini, **S. Ravelli**, "Simulation of Integrated Solar Combined Cycle coupled with Cooling Energy Production", Saudi Arabia Conference on Smart Grids and Green Energy (SASG 2013), November 24-27, 2013, Jeddah, Saudi Arabia.
- [33] G. Barigozzi, A. Perdichizzi, **S. Ravelli**, "Performance prediction and optimization of a waste-to-energy cogeneration plant with combined wet and dry cooling system", *Applied Energy* 2014, 115:65-74.
- [34] **S. Ravelli**, G. Barigozzi, "Adiabatic and conjugate simulations on the flow field in a gas turbine vane with pressure side film cooling and trailing edge cutback", *Proc IMechE Part A: J Power and Energy* 2014, 228 no. 6 657-673.
- [35] **S. Ravelli**, G. Barigozzi, "Application of unsteady CFD methods to trailing edge cutback film cooling", ASME Paper GT2014-25435, *published on J. Turbomach* 2014, 136/121006-1:11.

- [36] **S. Ravelli**, G. Barigozzi, F. Pasqua, R. Pieri, R. Ponzini, "Numerical and experimental study for the prediction of the steady, three dimensional flow in a turbine nozzle vane cascade using OpenFoam", International CAE Conference 2014, October 27-28, 2014, Pacengo del Garda, Verona, Italy.
- [37] A. Perdichizzi, G. Barigozzi, G. Franchini, **S. Ravelli**, "Peak shaving strategy through a solar combined cooling and power system in remote hot climate areas", *Applied Energy* 2015, 143:154-163.
- [38] **S. Ravelli**, G. Barigozzi, "Modelling the Influence of Vortex Shedding on Trailing Edge Cutback Film Cooling at Different Blowing Ratios", 11th European Turbomachinery Conference, March 23-27, 2015, Madrid, Spain.
- [39] G. Barigozzi, P. Epis, A. Perdichizzi, **S. Ravelli**, "Aero-thermal Investigation of End Wall and Showerhead Cooling in a Nozzle Vane Cascade", 11th European Turbomachinery Conference, March 23-27, 2015, Madrid, Spain.
- [40] A. Perdichizzi, G. Barigozzi, G. Franchini, **S. Ravelli**, "Performance Prediction of a CSP Plant Integrated with Cooling Production", 7th International Conference on Applied Energy – ICAE2015, March 28 - 31, 2015, Abu Dhabi, United Arab Emirates; *published on Energy Procedia* 2015, 75: 436-443.
- [41] G. Franchini, A. Perdichizzi, G. Barigozzi, **S. Ravelli**, "Simulation and Performance Assessment of Load-Following CSP Plants", 3rd Southern African Solar Energy Conference - SASEC2015, May 11-13, 2015, Skukuza, South Africa.
- [42] G. Barigozzi, **S. Ravelli**, "Combined Experimental and Numerical Study of Showerhead Film Cooling in a Linear Nozzle Vane Cascade", ASME Paper GT2015-42397.
- [43] **S. Ravelli**, G. Barigozzi, "Assessment of SAS and DDES predictive capability of trailing edge cutback coolant ejection", 12th International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows (ISAIF12), July 13-16, 2015, Lerici, Italy.
- [44] **S. Ravelli**, G. Barigozzi, "Comparison of RANS and DES modeling against measurements of leading edge film cooling on a first stage vane", ASME Paper GT2016-57567, *published on J. Turbomach* 2017, 139(5)/051005-1:12.
- [45] G. Franchini, A. Perdichizzi, **S. Ravelli**, "Performance prediction of solarized CC power plants operating in a load-following strategy", Power-Gen Africa 2016, July 19-21, 2016, Johannesburg, South Africa.
- [46] **S. Ravelli**, G. Franchini, A. Perdichizzi, S. Rinaldi, V.E. Valcarengi, "Modeling of Direct Steam Generation in Concentrating Solar Power Plants", 71^o Congresso Nazionale ATI, 14-16 settembre 2016, Torino, *published on Energy Procedia* 2016, 101:464-471.
- [47] H.Sumayli, A. Al Zahrani, A. Bin Dayel, A. Perdichizzi, G. Franchini, **S. Ravelli**, "Comparative Analysis of Different CSP Plant Configurations in Saudi Arabia", 2016 Saudi Arabia Smart Grid (SASG 2016), December 6-8, 2016, Jeddah, Saudi Arabia.
- [48] **S. Ravelli**, G. Barigozzi, E. Casartelli, L. Mangani, "Assessment of transition modeling and compressibility effects in a linear cascade of turbine nozzle guide vanes", *Journal of Fluids Engineering* 2017, 139: 051104-1:13.
- [49] G. Barigozzi, **S. Ravelli**, A. Armellini, L. Casarsa and L. Furlani, Flow field inside a leading edge cooling channel with turbulence promoters in rotating conditions, Proc IMechE Part A: J Power and Energy 2017, 231(4)/274-289.
- [50] G. Barigozzi, S. Mosconi, A. Perdichizzi, **S. Ravelli**, "The effect of hot streaks on a high pressure turbine vane cascade with showerhead film cooling", 12th European Turbomachinery Conference, April 3-7, 2017, Stockholm, Sweden. *Published on Int. J. Turbomach. Propuls. Power* 2017, 2(3), 15; doi:10.3390/ijtp2030015.
- [51] G. Barigozzi, **S. Ravelli**, H. Abdeh, A. Perdichizzi, M. Henze, J. Krueckels, "Heat transfer analysis over a film cooled platform of a vane cascade with a non-uniform inlet flow", ASME Paper GT2017-64266, pp. V05AT13A005.
- [52] **S. Ravelli**, G. Franchini, A. Perdichizzi, "Comparison of different CSP technologies for combined power and cooling production", *Renewable Energy* 2018, 121:712-721.

- [53] **S. Ravelli**, G. Barigozzi, “Stress-Blended Eddy Simulation of Coherent Unsteadiness in Pressure Side Film Cooling Applied to a First Stage Turbine Vane”, *Journal of Heat Transfer* 2018, 140: 092201-1:14.
- [54] **S. Ravelli**, G. Barigozzi, “Dynamics of coherent structures and random turbulence in pressure side film cooling on a first stage turbine vane”, ASME paper GT2018-75035, *accepted for publication in J. Turbomach.*
- [55] **S. Ravelli**, A. Perdichizzi, “Performance assessment of an integrated gasification combined cycle under flexible operation”, ASME paper GT2018-75198.

Presentations at conferences & workshops

- [56] **S. Ravelli**, G. Barigozzi, F. Pasqua, R. Pieri, R. Ponzini, “Predictions of the steady, 3D flow in a turbine nozzle vane cascade using OpenFOAM: a numerical and experimental comparison”, OpenFOAM User Conference 2014, October 7-9, 2014, Berlin, Germany.
- [57] **S. Ravelli**, G. Barigozzi, “A combined experimental and numerical workflow for film cooling investigation in a high pressure turbine”, WS1: “New advances in gas turbine design”, Conference on Modelling Fluid Flow (CMFF'15), September 1-4, 2015, Budapest, Hungary.
- [58] **S. Ravelli**, “Hybrid RANS/LES modelling of film cooling in high-pressure turbine vanes”, HPC Methods for Engineering Applications, June 18-20, 2018, CINECA, MILANO Office.