

# University Academic Curriculum Vitae

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## CONTACT INFORMATION

Name: Carlo Caligiuri  
Website: [Personal Google Webpage](#)



## EDUCATION SINCE LEAVING SCHOOL

**Università della Calabria**, Arcavacata di Rende (Cosenza), Italy

B.S., Mechanical Engineering, September 2012

- Grade: 109/110
- Thesis: *The Stirling engine: operating principles, modeling and designs, future energy developments and applications.*
- Supervisor: Prof. Gaetano Florio

M.S., Energy Engineering, May 2015

- Grade: 110/110 cum Laude
- Thesis: *Laser Induced Fluorescence in gases: thermometric investigations and spectroscopic experimental characterization of acetone, naphthalene and toluene as a LIF tracers.*
- Supervisor: Prof. Angelo Algieri

**Free University of Bozen-Bolzano**, Bolzano, Italy

Ph.D., Sustainable Energy and Technologies, July 2019

- Thesis: *The use of liquid and gaseous biofuels in internal combustion engines for micro-cogeneration systems: a fossil fuel substitution approach.*
- Supervisors: Prof. Marco Baratieri, Prof. Massimiliano Renzi
- Area of Study: Fluid Machines and Energy systems

Post-graduate courses and specializations

- Expert Degree: *Numerical simulation in Engineering with Ansys - Fundamentals and Application of Computational Fluid Dynamics* - Technical University of Madrid, 2016
- Postgraduate Course: *Combustion - Theory and Applications* - Polytechnic University of Milan, 2016
- Summer School: *Computational Fluid Dynamics* - Free University of Bozen-Bolzano, 2016
- Winter School: *How to shape and describe future energy systems - Helmholtz Research School on Energy Scenarios* - Karlsruhe Institute of Technology, 2017
- Winter School: *Fluid Machines and Energy Systems* - University of Pisa, 2017

## PRESENT APPOINTMENT

**Free University of Bozen-Bolzano**, Bolzano, Italy

- Level of appointment: Postdoctoral Researcher - Research Assistant
- Start of appointment: April 2022

## PROFESSIONAL EXPERIENCE

**Institute of Applied Physics "Nello Carrara" (IFAC) - CNR**, Sesto Fiorentino (Firenze), Italy

- Job title: Postdoctoral Researcher
  - From/To: March 2021/March 2022
- Description of responsibilities:
- I was involved in the application of remote sensing based methodologies to renewable energy, in particular to offshore wind farms planning and design.
  - I was involved in the implementation of atmospheric radiative transfer codes as part of the ESA FORUM project.

**Sesta Lab**, Radicondoli (Siena), Italy

- Job Title: Project Engineer
  - From/To: September 2020/March 2021
- Description of responsibilities:
- I was responsible for the submission of a research project proposal (IPCEI) related to the use of ammonia as a hydrogen carrier for energy production and innovative mobility applications.
  - I supported the design of a flameless ammonia/hydrogen gas combustor for industrial research purposes.
  - I monitored combustion experimental tests performed at the Sesta Lab facility and I was responsible for several Lab ancillary contracts.

**Free University of Bozen-Bolzano**, Bolzano, Italy

- Job Title: Postdoctoral Researcher
  - From/To: November 2018/August 2020
- Description of responsibilities:
- As part of a FESR project, in collaboration with Röchling Automotive, I investigated the design and the main technical issues of lithium batteries thermal management, for electric and hybrid vehicles.
  - I was involved in the quantification and valorization of forestry residual biomass for energy purposes.
  - I was co-responsible for the experimental activities of the Bioenergy & Biofuels Lab in the use of synthesis gas obtained from the gasification of forestry biomass in internal combustion engines for micro-cogeneration.
  - I developed and applied emissions and performance optimization algorithms for alternative-fueled micro-cogeneration systems.
  - I was involved in the investigation of the design and optimization of different energy polygeneration strategies.
  - I carried out teaching activities in the field of fluid machines and energy systems.
- Job Title: PhD Fellow
  - From/To: November 2015/November 2018
- Description of responsibilities:
- I developed a test bench for the use of liquid and gaseous biofuels in internal combustion engines based micro-cogeneration systems.
  - I carried out several experimental campaigns in order to investigate the use of bioethanol and biodiesel blends as well as forestry biomass producer gas as a substitute for petrodiesel.
  - I carried out thermodynamic modeling of dual-fuel combustion of forestry biomass producer gas and diesel.
  - I worked on the use of syngas in microturbines with and without steam injection (STIG cycle)
  - I carried out studies on the optimization of the Urea injection process in SCR systems of diesel engines.

- I co-supervised two master theses and one bachelor thesis. I have been directly involved in the writing of European, national and internal research projects. I have given oral presentations and presented scientific posters at several international conferences.

**CNH Industrial - FPT Powertrain**, Torino, Italy

- Job Title: Traineeship
- From/To: August 2015/December 2015
- Description of responsibilities:
  - Collection, analysis, and presentation of sales and order data from major FPT Group engines.

**Von Karman Institute for Fluid Dynamics**, Sint-Genesius-Rode, Belgium

- Job Title: Master Thesis Short Training Program
- From/To: January 2015/April 2015
- Description of responsibilities:
  - I developed a test bench and conducted an experimental campaign in the field of Laser Induced Fluorescence, aiming at identifying the best tracer components for thermometric applications.

EXPERIENCE IN  
ACADEMIC  
TEACHING

**Free University of Bozen-Bolzano**, Bolzano, Italy

*Lecturer*

- "Internal combustion engines for hybrid powertrains" - 3CFU - Master Degree in Energy Engineering AY 2019-2020

*Teaching assistant*

- Exercises of "Fundamentals of Machinery and Oleodynamic" - Bachelor Degree in Industrial Engineering AY 2019-2020
- Exercises of "Fundamentals of Machinery and Oleodynamic" - Bachelor Degree in Industrial Engineering AY 2018-2019

OTHER ACADEMIC  
RESPONSIBILITIES

**Events organization**

- Member of the Organizer Committee of the workshop "Giornata di Studio AIMSEA sulle Macchine Idrauliche" organized by "Associazione Italiana delle Macchine a fluido e dei Sistemi per l'Energia e l'Ambiente" Bolzano, 2020

MEMBERSHIPS

**Editorial Boards**

- Editor of the Special Issue "Advances in Biomass Energy Conversion and Thermochemical Processes" - 2021/2022, Energies, MDPI

**Scientific committees for international conferences**

- Member of the Scientific Advisory Board SDEWES - Sustainable Development of Energy Water and Environment Systems, Paphos (Cyprus), 2022
- Member of the Scientific Advisory Board LA-SDEWES - Latin America conference on Sustainable Development of Energy Water and Environment Systems, Sao Paulo (Brazil) 2022

- Member of the Scientific Advisory Board SEE-SDEWES - South East European conference on Sustainable Development of Energy Water and Environment Systems, Vlorë (Albania), 2022
- Member of the Scientific Advisory Board SDEWES - Sustainable Development of Energy Water and Environment Systems, Dubrovnik (Croatia), 2021

## RESEARCH AND SCHOLARSHIPS

### Summary of current research interests

The main topics on which my current research interests are based are:

- Use of biomass-based alternative fuels in thermal engines
- Experimental investigations and thermodynamics modeling of combustion systems
- Single and multi-objective optimization strategies for distributed energy systems
- Use of remote sensing techniques for the optimal exploitation of renewable energy sources

### Projects

#### *Research, Management, and Proposal preparation*

- COOLCAR "Thermal management of the accumulator batteries in electric and hybrid cars: optimization strategies for performance enhancing and for a sustainable mobility" - FESR Project, UNIBZ and Röchling Automotive
- "Design and study of the performance of a microcogeneration system using internal combustion engine fuelled by intermediate fuels from biomasses" - UNIBZ Internal project
- "Experimental measurement system of the heat recovered by micro cogeneration systems" - UNIBZ Internal project
- "Study of the combustion and of the engine management strategy of a dual fuel internal combustion engine fed with alternative fuels" - UNIBZ Internal project

#### *Proposal preparation*

- H2BEE "Ammonia for smart mobility"- European IPCEI Project, Sesta Lab
- "Pollutant abatement solutions for small-scale cogeneration systems and combustion systems fed with traditional and alternative fuels" - UNIBZ Internal project

#### *Research*

- BIO-CHEAPER "BIOmasses Circular Holistic Economy APproach to EneRgy equipments" - National PRIN project
- BIO-TRACT-EFFICIENCY "Experimental investigation on the efficiency of agricultural machines powered with different fuels" - UNIBZ Internal project
- VISCOMOTOR "Effects of biofuels on lubricants performance in internal combustion for agricultural purposes" - UNIBZ Internal project

#### *External Consultancy*

- "Study of the SCR systems for the abatement of NOx emissions in the automotive sector" - UNIBZ, commissioned by Röchling Automotive

### Grants and scholarships

#### *Graduate*

- Post-doc Research Fellowship ("Assegno di ricerca") - IFAC-CNR (03/2021-03/2022)
- Post-doc Research Fellowship ("Assegno di ricerca") - Libera Università di Bolzano (11/2019-08/2020)
- Research Fellowship ("Assegno di ricerca") - Libera Università di Bolzano (11/2018-11/2019)

- PhD Fellowship - Libera Università di Bolzano (11/2015-11/2018)

*Undergraduate*

- Erasmus+ Fellowship - Von Karman Institute of Fluid Dynamics (2015)
- Erasmus Fellowship - Leibniz Universität Hannover (2014)

PUBLICATIONS

**Journal Papers**

- [1] Caligiuri, C., L. Stendardi, and M. Renzi. The use of sentinel-1 ocn products for preliminary deep offshore wind energy potential estimation: A case study on ionian sea. *Engineering Science and Technology, an International Journal*, 35:101117, 2022.
- [2] F.F. Nicolosi, J.C. Alberizzi, Caligiuri, C., and M. Renzi. Unit commitment optimization of a micro-grid with a milp algorithm: Role of the emissions, bio-fuels and power generation technology. *Energy Reports*, 7:8639–8651, 2021.
- [3] M.A. Perez Estevez, S. Calligaro, O. Bottesi, Caligiuri, C., and M. Renzi. An electro-thermal model and its electrical parameters estimation procedure in a lithium-ion battery cell. *Energy*, 234, 2021.
- [4] Caligiuri, C., M. Renzi, D. Antolini, F. Patuzzi, and M. Baratieri. Diesel fuel substitution using forestry biomass producer gas: Effects of dual fuel combustion on performance and emissions of a micro-chp system. *Journal of the Energy Institute*, 98:334–345, 2021.
- [5] M. Bietresato, A. Bolla, Caligiuri, C., M. Renzi, and F. Mazzetto. The kinematic viscosity of conventional and bio-based fuel blends as a key parameter to indirectly estimate the performance of compression-ignition engines for agricultural purposes. *Fuel*, 298, 2021.
- [6] Caligiuri, C., U.Ž. Baškovič, M. Renzi, T. Seljak, S.R. Oprešnik, M. Baratieri, and T. Katrašnik. Complementing syngas with natural gas in spark ignition engines for power production: Effects on emissions and combustion. *Energies*, 14(12), 2021.
- [7] M. Bietresato, Caligiuri, C., A. Bolla, M. Renzi, and F. Mazzetto. The response surface methodology as a tool to evaluate the effects of using diesel-biodiesel-bioethanol blends as farm tractor fuel. *Lecture Notes in Civil Engineering*, 67:539–549, 2020.
- [8] Caligiuri, C., M. Renzi, M. Bietresato, and M. Baratieri. Experimental investigation on the effects of bioethanol addition in diesel-biodiesel blends on emissions and performances of a micro-cogeneration system. *Energy Conversion and Management*, 185:55–65, 2019.
- [9] W. De Paepe, M. Renzi, M.M. Carrero, Caligiuri, C., and F. Contino. Micro gas turbine cycle humidification for increased flexibility: Numerical and experimental validation of different steam injection models. *Journal of Engineering for Gas Turbines and Power*, 141(2), 2019.
- [10] M. Bietresato, Caligiuri, C., A. Bolla, M. Renzi, and F. Mazzetto. Proposal of a predictive mixed experimental-numerical approach for assessing the performance of farm tractor engines fuelled with diesel-biodiesel-bioethanol blends. *Energies*, 12(12), 2019.
- [11] S. Vakalis, Caligiuri, C., K. Moustakas, D. Malamis, M. Renzi, and M. Baratieri. Modeling the emissions of a dual fuel engine coupled with a biomass gasifier—supplementing the wiebe function. *Environmental Science and Pollution Research*, 25(36):35866–35873, 2018.

## Conference Papers

- [1] M.A. Perez Estevez, *Caligiuri, C.*, and M. Renzi. A cfd thermal analysis and validation of a li-ion pouch cell under different temperatures conditions. *E3S Web of Conferences*, 238, 2021.
- [2] D. Antolini, B. Brianti, *Caligiuri, C.*, R. Borooh, F. Patuzzi, and M. Baratieri. Energy valorization of forestry residues through a small-scale open top gasifier. *European Biomass Conference and Exhibition Proceedings*, pages 407–410, 2020.
- [3] M. Bietresato, A. Bolla, *Caligiuri, C.*, M. Renzi, and F. Mazzetto. Analysis of cryoscopic behaviour of diesel-biodiesel blends using industrial freezer. *Engineering for Rural Development*, 19:1585–1593, 2020.
- [4] M. Bietresato, *Caligiuri, C.*, M. Renzi, and F. Mazzetto. Use of diesel-biodiesel-bioethanol blends in farm tractors: First results obtained with a mixed experimental-numerical approach. *Energy Procedia*, 158:965–971, 2019.
- [5] *Caligiuri, C.*, M. Bietresato, and M. Renzi. The effect of using diesel-biodiesel-bioethanol blends on the fuel feed pump of a small-scale internal combustion engine. *Energy Procedia*, 158:953–958, 2019.
- [6] W. De Paepe, M. Renzi, M.M. Carrero, *Caligiuri, C.*, and F. Contino. Micro gas turbine cycle humidification for increased flexibility: Numerical and experimental validation of different steam injection models. *Proceedings of the ASME Turbo Expo*, 3, 2018.
- [7] *Caligiuri, C.*, D. Antolini, F. Patuzzi, M. Renzi, and M. Baratieri. Modelling of a small scale energy conversion system based on an open top gasifier coupled with a dual fuel diesel engine. *European Biomass Conference and Exhibition Proceedings*, 2017(25thEUBCE):788–793, 2017.
- [8] *Caligiuri, C.* and M. Renzi. Combustion modelling of a dual fuel diesel-producer gas compression ignition engine. *Energy Procedia*, 142:1395–1400, 2017.
- [9] M. Renzi, *Caligiuri, C.*, and M. Rossi. Micro-gas turbine feed with natural gas and synthesis gas: Variation of the turbomachines' operative conditions with and without steam injection. *Proceedings of the ASME Turbo Expo*, 8, 2017.
- [10] *Caligiuri, C.*, M. Renzi, D. Antolini, F. Patuzzi, and M. Baratieri. A sequential quadratic programming emissions optimization strategy for a producer gas/diesel engine. *Digital Proceedings of SDEWES 2020*, 2020.

## FURTHER DATA

### Presentations at scientific conferences

#### Oral Presentations

- C. Caligiuri, Massimiliano Renzi, Daniele Antolini, Francesco Patuzzi, Marco Baratieri; A Sequential Quadratic Programming Emissions Optimization Strategy for a Producer Gas/Diesel Engine, SDEWES 2020 - Sarajevo (Online Conference)
- C. Caligiuri, Marco Poda, Marco Bietresato, Angelo Algieri, Marco Baratieri, Massimiliano Renzi; Effects on NOx Emissions of Different Injection Timings in a Micro-Cogeneration Unit Fuelled with Biodiesel, SDEWES 2020 - Sarajevo (Online Conference)
- C. Caligiuri, D. Antolini, F. Patuzzi, M. Renzi, M. Baratieri, Experimental investigation on an open top downdraft gasifier coupled with a dual fuel compression ignition engine micro-cogeneration system, 7th International conference on Engineering for Waste and Biomass Valorization 2018, Prague

- C. Caligiuri, M. Bietresato, M. Renzi, The effect of using diesel-biodiesel-bioethanol blends on the fuel feed pump of a small-scale internal combustion engine, ICAE 2018, Hong Kong

*Poster Presentations*

- Caligiuri C., Renzi M., Baratieri M., Development of a 0D Thermodynamics Combustion Simulation Tool for a Dual Fuel Diesel – Producer Gas Engine, European Combustion Meeting 2017, Dubrovnik
- Caligiuri, C., Antolini, D., Patuzzi, F., Renzi, M., Baratieri, M., Modelling of a small scale energy conversion system based on an open top gasifier coupled with a dual fuel diesel engine, European Biomass Conference and Exhibition 2017, Stockholm
- D. Antolini, S. S. Ail , C. Caligiuri, F. Patuzzi , M. Renzi, M. Baratieri, Load modulation capability of an open top gasifier by varying the second stage air flow rate (Best Student Poster Award), 7th International conference on Engineering for Waste and Biomass Valorization 2018, Prague

**Skills**

*Data analysis and presentation*

- Matlab/Octave, Excel, Python, R

*Experimental data acquisition*

- Labview

*Text processing and visual presentation*

- Word, Latex, Powerpoint, Beamer

*Engineering simulations, processing, and design*

- SolidWorks, FreeCAD, Ansys Fluent, Amesim, AVL Boost, DWSIM, Open-Modelica

*Physical modelling and programming*

- Matlab/Octave, Simulink, Fortran

LANGUAGE  
COMPETENCE

English (C1), German (A1)