Stefano Briola Curriculum Vitae

Education since leaving school

- 2015, Ph.D. degree in Engineering - Program in Electrical and Thermal Energetics, Engineering Ph.D. School “Leonardo da Vinci”, University of Pisa (Italy) with the thesis entitled “Analisi delle prestazioni di cicli termodinamici di co-trigenerazione operanti con espansori e compressori a fluido bifase”;
- 2007, M.Sc. degree (five-years MEng level) in Mechanical Engineering, University of Pisa (Italy) awarded with 110/110 summa cum laude with the thesis (in collaboration with ENEL GEM Technical Research Area) entitled “Studio di un impianto termoelettrico a carbone con combustione in acqua supercritica a zero emissioni di CO_2”.

Professional experience

From/to	Job title	Name of Academic Institution	Academic level	Responsibilities
04.2021/ 06.2021	Teaching Assistant	University of Trento	Junior Assistant Professor	Co-Instructor of the course “Fluid machines Engineering”
10.2020/ 01.2021	Teaching Assistant	Free University of Bolzano	Junior Assistant Professor	Co-Instructor of the course “Fundamentals of machinery and oleodynamic”
04.2020/ Today	Junior University Researcher	Free University of Bolzano	Junior Assistant Professor	i) Thermo-fluid dynamic, energy and environmental analysis of fluid machines and insertion of these machines in industrial and civil power generation and propulsion systems; ii) Instructor of the course “Advanced methods for fluid machines design”
12.2018/ 11.2019	Postdoctoral Researcher	German Engineering R&D Center LSTME Busan, Affiliate Institute to FA Universität Erlangen (Busan, South Korea)	Postdoc.	i) Modelling and simulation (in Aspen Plus®) of Liquid Air Energy Storage plants integrated with Natural Gas Combined Cycles; ii) Elaborating applications for third-party funded projects
08.2016/ 08.2018	Research Scientist	Center of Energy Systems - Skolkovo Institute of Science and Technology	Postdoc.	Modelling and simulation of: i) hybrid binary geothermal biomass power plants

		(Moscow, Russia)		(in Aspen Plus® and Aspen EDR®); ii) Novel Combined Cooling Heating and Power thermodynamic cycles with two-phase machines (in Aspen Plus®); iii) Vanadium Redox Flow Batteries (in Matlab®)
06.2016/ 08.2016	Postdoctoral Researcher	Center of Energy Systems - Skolkovo Institute of Science and Technology (Moscow, Russia)	Postdoc.	Review of the state-of-the-art of hybrid binary geothermal biomass power plants
07.2015/ 01.2016	Postdoctoral Research Fellow	Department of Civil and Industrial Engineering - University of Pisa (Italy) in collaboration with ENEL Engineering and Research SpA	Postdoc.	Comparison analysis (by developed system in Matlab®) of the performances of Compressed Air Energy Storage plants
09.2013/ 05.2014	Research Fellow	Department of Civil and Industrial Engineering - University of Pisa (Italy) in collaboration with ENEL Engineering and Research SpA	Post graduate	Design and development of a system (in Matlab®) for the technical and economic optimization of the configuration of Compressed Air Energy Storage plants
11.2007/ 02.2008	Research Fellow	Department of Energetics - University of Pisa (Italy)	Post graduate	Modelling and simulation (in Aspen Plus®) of binary geothermal power plants with supercritical fluids

- From 12.2008 to 05.2011, R&D Engineer at Energy Resources SpA (Ancona, Italy): i) in collaboration with the Department of Energetics of the University of Pisa (Italy) for the development of a system (in Matlab®) for the design of geothermal plants consisting of patented geothermal probes for space conditioning (heating and cooling) and for the development of the “Thermal Response Test” for the experimentally characterization of the soil thermal properties; ii) development of a prototype of a photovoltaic-thermal panel; iii) patenting processes.
- From 01.2008 to 06.2008, Proposal Engineer at Fores Engineering srl (Forlì, Italy) for the tender preparation in the oil&gas sector.

Experience in academic teaching

- Instructor of the course entitled “Advanced methods for fluid machines design” at the MSc program in Science and Technology (Free University of Bolzano);
- Co-Instructor of the course “Fundamentals of machinery and oleodynamic” at the MSc program in Science and Technology (Free University of Bolzano);
- Co-Instructor of the course “Fluid machines Engineering” at the MSc program at University of Trento;
- Teaching assistant of the course (Dr. Aldo Bischi) entitled “Energy Systems (Physics) & Technology” at the MSc program in Energy Systems Science and Engineering (Skolkovo Institute of Science and Technology - Moscow, Russia): i) frontal lectures for the modelling and simulation in Aspen® of energy conversion processes; ii) evaluation of students’ project works;
- Co-supervision of no. 1 PhD student for the modelling and simulation in Matlab® of Vanadium Redox Flow Batteries.

Research and scholarships

Current research:

- The undersigned is the Scientific Manager of the project “Next REnewable multi-GENeration technology enabled by TWO-phase fluids machines” (i.e. “REGEN-BY-2”) of the European H2020 call “Developing the next generation of renewable energy technologies”. REGEN-BY-2 is based on the undersigned’s near-worldwide patent WO2017158511A1 (See Section “Entrepreneurship”). It concerns a CCHP thermodynamic cycle with two-phase expanders and two-phase compressors, and was conceived implementing significant improvements to the CCHP thermodynamic cycles investigated during his PhD. The main advantages of the patented concept over the commercialized CCHP plants are: i) higher flexibility, i.e. the capability to satisfy the requirements of the CCHP end-users with simultaneously varying powers (i.e. heating, cooling and electric) and-or temperatures related to heating and cooling powers in wider ranges; ii) higher energy performances, i.e. the saving of the thermal heat source with fixed requirements of the CCHP end-users. In December 2019, REGEN-BY-2 was financed with budget 5 M€. REGEN-BY-2 involves an International Consortium of 13 Partners (Universities, Research and Technological Organizations, SMEs and Large Enterprises) from six EU Countries (Italy, Spain, France, Greece, Belgium and Germany) and one extra EU Country (South Korea). As result of this research, the undersigned is the main author of one Scopus article, which will be submitted on Energy in the next December.
- During his experience at LSTME Busan (Busan, South Korea) as Postdoctoral Researcher, the undersigned has investigated a novel integration of an advanced configuration of Liquid Air Energy Storage (LAES) plant and an additional gas turbine cycle with an existing large-scale Natural Gas Combined Cycle (NGCC). The undersigned has elaborated a simulation mathematical model (in Aspen Plus®) of the integrated plant in order to carry out the energy performance analysis at off-design conditions. He also has performed an economic uncertainty analysis in three different scenarios (i.e. expected, optimistic and pessimistic) to assess the profitability of the installation and operation of the integrated plant compared to the stand-alone NGCC. The profitability of the integrated plant is higher compared to the stand-alone

NGCC in the expected and optimistic scenario. As result of this research, the undersigned is the main author of one Scopus article, which is under review on Energy Conversion and Management.

Past five-years research:

- During his experience at the Skolkovo Institute of Science and Technology (Moscow, Russia) as Research Scientist, the undersigned has investigated a novel configuration of a hybrid binary geothermal biomass power plant. It generates electricity through the Organic Rankine Cycle (ORC), which receives the thermal power provided by a biomass heat source through intermediate geothermal fluid. The plant is located in regions with extreme environmental conditions where water is not available. The modification of the biomass mass flow rate is used to overcome the simultaneous harmful effects of a considerable reduction in the geothermal fluid temperature during the operative life of the plant and the more significant seasonal change of the ambient air temperature. The undersigned has elaborated the simulation mathematical model of the hybrid binary geothermal biomass power plant (in Aspen Plus® and Aspen EDR®), evaluating the energy performance in off-design conditions, i.e. in the presence of the simultaneous changes of the biomass flow rate, ambient air temperature and geothermal fluid temperature. The biomass flow rate is controlled to maximize the net electric power or net thermodynamic efficiency of the plant with varying ambient air and geothermal fluid temperatures. In particular, the ORC turbine operated in a sliding pressure mode with a fixed nozzle area and its behaviour at off-design conditions was modelled according to the Stodola's ellipse approach. As result of this research, the undersigned is the main author of one Scopus article (no. 2 in Section "Publications"). On the other hand, the undersigned continued and deepened the investigation on the novel CCHP thermodynamic cycle, which was previously performed during his PhD. He elaborated a simulation mathematical model in Aspen Plus® and performed and extensive sensitivity analysis in steady state conditions. As result of this research, the undersigned is the main author of one Scopus article (no. 1 in Section "Publications"). Finally, the undersigned has contributed to the investigation of the Vanadium Redox Flow Batteries, developing a simulation mathematical model in Matlab®. As result of this research, the undersigned is co-author of two Scopus articles (no. 3 and 4 in Section "Publications") and co-author of one conference paper (no. 1 in Section "Conference Proceedings").
- During the two Research Fellowships at the University of Pisa (Italy), the undersigned has investigated different configurations (i.e. diabatic, adiabatic and hybrid) of Compressed Air Energy Storage (CAES) plants. He has elaborated a simulation mathematical model (in Matlab®) for the evaluation of the behaviour of the CAES plants in time-dependent conditions. In particular, the time-varying operation points of the turbomachinery (i.e. compressors and turbines) were accurately determined through the implementation of the respective characteristic curves. The present simulation mathematical model of the compressors and turbines can be used to simulate different energy systems where the turbomachinery have to operate in time-varying operation conditions, such as geothermal power plants with lowering geothermal source, or concentrated solar systems without thermal storage. In addition, through the abovementioned simulation mathematical model, the undersigned has carried out a sensitivity analysis of the hybrid CAES configuration due to the simultaneous change of several process parameters. In particular, he has applied the methodology "Design of Experiments" to

the results of the sensitivity analysis in order to determine the main effects of each process parameter on each energy performance indicator. As result of this research, the undersigned is the main author of two Scopus articles (no. 5 and 7 in Section “Publications”);

- During his PhD studies at the University of Pisa (Italy), the undersigned has conceived and investigated novel Combined Cooling Heating and Power (CCHP) thermodynamic cycles with two-phase fluid devices (expanders and compressors). Unlike traditional machines, two-phase devices are able to work with chemical species constituted by both liquid and vapor phases. The undersigned has elaborated the simulation mathematical model (in RefProp®) of the novel CCHP thermodynamic cycles in steady state conditions and has evaluated their energy performances. In particular, these CCHP cycles have high flexibility, i.e. they are capable to satisfy simultaneously the heating, cooling and electric powers varying in wide ranges, which are required by different types of end-users with fixed operating temperatures (e.g. tertiary and industrial end-users). As result of this research, the undersigned is the main author of one Scopus article (no. 6 in Section “Publications”) and the main author of two conference papers (no. 2 and 4 in Section “Conference Proceedings”).

Entrepreneurship

1. Briola S. Plant and method for the supply of electric power and/or mechanical power, heating power and/or cooling power, Patent WO2017158511A1, 21.09.2017. The PCT Application IB2017/051471 has received in 2017 completely favorable EPO written opinion, the Italian Patent 102016000027735 was released in 2018, the PCT was extended in 2018 in EU, USA, China, India, Australia, Japan and Canada;
2. Co-founder and major stakeholder of the innovative start-up “Tifeo srl” (via Bradano 3 - 65015 Montesilvano, Pescara, Italy, www.tifeo.eu), which is the exclusive licensee of the abovementioned patent WO2017158511A1.

Language competence

- Italian: mother tongue
- English: understanding B2, speaking B2 and writing B2

Driving license Type B

Place and date
Bolzano, 08.10.2021

Signature