Edoardo Gino Macchi, PhD

e-mail: emacchi@fbk.eu
web: www.researchgate.net/profile/Edoardo_Macchi

March 2024

Areas of expertise

redox flow and Li-ion batteries • electric and thermal energy storage • mathematical models • CFD multi-physics simulations • cell and battery testing • electrochemistry • electricity grids and markets hybrid energy storage systems • hydrogen & fuel cells

Work experience

Researcher   FBK - Centre Sustainable Energy, Trento, Italy   Feb. 2018 – present

- since 2024 Head of Battery and Electrification Technologies unit;
- from 2021 till 2023 supervisor for the area Battery Technologies of the Centre;
- since 2019 leading battery R&D activities at FBK and main contact for smart-grids projects;
- managing a team of researchers and technicians (around 15 peoples) and supervising internships, master and PhD students;
- performing and coordinating R&D activities related to:
  - redox flow cell and stack design, prototyping and testing;
  - engineering design and optimization redox flow batteries at system level;
  - development and characterization of novel electrolytes for redox flow batteries and innovative solid-state electrolytes for Li-ion batteries;
  - development of multiphysics models for electrochemical devices (redox flow batteries, electrolyzers and Li-ion batteries) at different scales from system to cell level;
  - Li-ion cells and materials characterization;
  - Integration of multiple storage systems (batteries, supercaps, hydrogen-based ESS) in hybrid energy storage systems (HESSs) and in micro-grids;
  - flexibility in electric grids and demonstration of a near to real-time energy market;
  - techno-economic assessment of technologies (e.g., batteries, P2H, P2P) and their interactions with grids and markets;
- participation in EU and national research projects on batteries, electric grids and hydrogen in strong collaboration with the industry (e.g., SMHYLES, FREE4LIB, IPCEI EuBatIn, SINNOGENES ComESto, GREENERSYS, OSMOSE, GREENERNET, NEWELY, JIVE) and support to consultancy activities for industrial players;
- reference person for advanced modelling activities and responsible for the computational resources of the Centre (both HW and SW);
- person in charge of the Batteries laboratory: supervising activities, defining protocols and safety procedures, managing laboratory organization, expansion and equipment acquisition;

- responsible for the preparation of project proposals and project management/coordination in EU, national and regional research projects and consultancies;
- since 2021 main FBK representative in the Batt4EU partnership, actively contributing to several WGs, in particular those related to new materials, emerging battery technologies and stationary applications, also served as lead writer in HE topics drafting;
- since 2019 active participation in Batteries Europe contributing to several WGs (emerging battery technologies, mobility and stationary applications) and cross-cutting task forces (safety, digitalization) supporting the preparation of roadmaps, position papers and the revision of KPIs;
- since 2018 teaching 6 hours module "Batteries technologies" at AFP ENAIP, Villazzano, TN.

Postdoctoral researcher   IMFT, Toulouse, France   Apr. 2015 – Jul. 2017
- developed models for simulating and optimizing a large-scale bedrock-hosted thermo-electric energy storage system based on CO_2 transcritical cycles (including underground thermal energy storage, ice storage and charge/discharge thermodynamic cycles);
- performed CFD simulations of supercritical CO_2 flows;
- participated in experimental campaigns on a sCO_2 loop designed for heat transfer measurements.

Supervisors: Prof. Catherine Colin (IMFT)
              Dr. Nicolas Tauveron (CEA-LITEN)

Professional collaboration   DICAr, Università di Pavia, Italy   Jan. – Mar. 2015
- developed and implemented in OpenFOAM different models based on the theory of non-isothermal two-phase flows in porous media.

Supervisor: Prof. Mario Gallati

Doctoral researcher   Università di Pavia, Italy   Oct. 2011–Jan. 2015
- developed models in order to simulate electromagnetic heating of porous media and biological tissues (including electromagnetic fields, heat and mass transfer, fluid flow, liquid-vapor phase change and thermo-mechanical interactions);
- performed electro-thermal and multi-physics simulations aimed at designing experimental setups and modeling radiofrequency thermal ablation (RFA) experiments;
- developed and validated innovative solutions based on conductive hydrogels for enhancing RFA;
- conducted temperature and pressure measurements during RFA aimed at improving model validation (using infrared thermography, MEMS and fiber optic sensors).

Supervisor: Prof. Mario Gallati

Teaching assistant   Università di Pavia, Italy   2013 – 2014
- delivered lectures and conducted practical exercises;
- provided OpenFOAM® training for solving thermal and fluid dynamics problems.

Courses: Hydraulics, Numerical Methods in Fluid Mechanics
Lecturers: Prof. Mario Gallati, Prof. Stefano Sibilla

Professional collaboration   Fondazione CMT ONLUS, Pavia   Jun. – Oct. 2011
- evaluated the performances of new RF applicators through *ex vivo* experiments and electro-thermal simulations.

Supervisor: MD Sandro Rossi (Policlinico San Matteo, Pavia)

Education

PhD, Civil Engineering, Università di Pavia   Jan. 2015
  Thesis: "Experimental and numerical studies on RF ablation: advances on physical understanding and efficiency"
  Advisor: Prof. Mario Gallati

MSc, Environmental Engineering, Università di Pavia (*cum laude*)   Apr. 2011
  Thesis: "Modeling of vaporization in porous media subject to a radio-frequency electromagnetic field: the thermal ablation of hepatic tumors"
  Advisor: Prof. Mario Gallati

BSc, Environmental Engineering, Università dell'Insubria   Oct. 2008

Computer skills and competences

Operating systems	Microsoft Windows, Linux, macOS
Programming languages	C++, Python, Julia, MATLAB
FV and FE computational software	OpenFOAM, COMSOL, Ansys Fluent
Other modelling tools	Dymola/Modelica, Homer Energy, Ansys Simplorer,
CAD, pre- and post-processing software	Salome, Gmsh, Paraview, Solidworks, Autocad
Other software	Microsoft Office, Adobe Photoshop, Inkscape, Coolprop

Language skills and certificates

Mother tongue: Italian

	understanding	writing	speaking
English	advanced	advanced	advanced
French	advanced	intermediate	intermediate

Language certificates

English   Test of English for International Communication (TOEIC) Total Score: 975/990 Date: 09/11/2008

Hobbies and interests

I love running in the wilderness and cycling in the mountains. I have also practiced orienteering, obtaining good results in my junior years. Since I was a kid one of my favorites hobbies has been computer science. This passion and my strong interest in physics pushed me towards numerical simulation and scientific research.

Trento, 8th March 2024