Simona Gurri'

Email ◇ GitHub ◇ LinkedIn ◇ Homepage

Researcher with vertical expertise in Computational Fluid Dynamics (CFD) and horizontal knowledge in transportation systems. Passionate about leveraging advanced simulation techniques to drive innovation in sustainable mobility and energy efficiency.

Position

Politecnico di Torino, Italy
Research Fellow
Energy engineering - Computational Fluid Dynamics
Alessandro Ferrari (advisor)

Affiliation

2023 - present	Dept. of Energy (DENERG) - Politecnico di Torino
2021 - 2023	Dept. of Environment, Transport and Infrastructure (DIATI) - Politecnico di Torino

Interests

Topics	Simulation and modeling · Powertrain and power generation · Transportation systems
Methods	Reactive Computational Fluid Dynamics · Time Frequency Analysis · Model Based System Engineering · Discrete Event Simulation · Microsimulation

Education

Politecnico di Torino Italy
Doctoral candidate in Energy Engineering 2021 - Present

- Thesis: "Synergies of Bimodal Freight Electric Multiple Units Trains and Advanced ICE Technologies for Sustainable Intermodal Transport" Supervisors: Ferrari A., Dalla Chiara B.

Ordine degli Ingegneri della Provincia di Torino Italy
Professional Engineer 2022 - Present

- Licensed and qualified to practice as Industrial Engineer. Registered in the Order of Engineers of Turin, Reg. No. 14648.

EPF Sceaux France
M.Sc. in Mechanical Engineering 2019 - 2020

- Final project: "Modélisation et simulation des procédés de étanchéification d'une bague en Nitinol pour un accélérateur de particules". Supervisor: Belhadj C.
- Courses held in French.

Politecnico di Torino Italy
B.Sc. and M.Sc. in Mechanical Engineering 2015 - 2021

- Grade: 110/110 · M.Sc. thesis: "Functional Testing of a passenger train: the case of the Donizetti regional rolling stock–Systems Engineering approach and basis for Remote Prognostics" Supervisors: Dalla Chiara B., Bonamico M.

Professional Experience

B4IA project @ Politecnico di Torino
Research Fellow 11/2024 - Present

- Fellowship funded by the *Italian Ministry of Economics*.
- Design and prototyping (TRL 6) of an autonomous bus with a **PFI hydrogen-fueled internal combustion engine**. Focus on engine and injection system (**1D CFD** and **3D CFD** simulations for injectors' and combustion chamber design).
- Collaborating with industrial partners in Piedmont region (*Blue Engineering S.p.A., Italtecnica, De Marco S.p.A., Reply*).

Politecnico di Torino

Doctoral Researcher 11/2021 - 10/2024

- Advanced CFD modeling of turbulence-combustion interactions in low-carbon fuel engines. **CONVERGE CFD** employed for 3D RANS simulations using **RNG k-ε** turbulence model. Integration of **PDF** for the combustion models with detailed kinetics to capture turbulence-chemistry interaction. Validation against engine data provided by *FPT industrial*. Development of a new methodology for **boundary condition optimization** in 3D CFD simulations of engines. Development of a new **spark deposition model for SI engines** in CONVERGE. **CINECA HPC Galileo100** cluster and **Polito HPC** efficiently used (considering Amdahl law and resources availability). Benchmarked 5 operating points for natural gas/methanol/ethanol fuels.
- Development of 1D turbulence model for converted heavy duty engines. CONVERGE employed for analyzing turbulent kinetic energy/dissipation patterns across different engine operating points. Calibration of 1D turbulence model in **GT-Power** showing improved combustion prediction accuracy vs. Turb-SI conventional model for experimental CNG data from *FPT Industrial*.
- **Time Frequency Analysis** of combustion to set-up a fast predictive real-time model in **Matlab** for engine operation with alternative fuels that show flame instability. In partnership with *FPT Industrial*.
- Functional design of a next-generation freight train with distributed power. **System Composer** has been used for architecture design and requirement management. **Simulink** for simulating and validating the Integrated Monitoring System. **GaBi** used for **Life Cycle Analysis** considerations on the powertrain. In partnership with *Alstom S.A.*.
- Simulating the operation of a next-generation freight train and their integration in intermodal logistic chains. **OpenTrack** and **Trenissimo** have been used for simulation of railway lines and terminals. **Anylogic** has been used for integrating microsimulation inside the processes of container handling at terminals. Use of **Galileo High Accuracy Service** for satellite-enhanced operation has been validated. **ARENA Discrete Events Simulation** has been used for the entire combined logistic chain simulation. In collaboration with *RFI* and *SITO interporto di Torino*.
- Coded a microsimulation tool for railway in **Python** for comparing different powertrain technologies for trains. The novelty consisted in automatically reconstructing the railway line through **OpenRailwayMapAPI** and **Google Maps API**
- Electric yard tractor economical and technical convenience. GPS and accelerometer data collection, **techno-economic analysis**, in partnership with *PSA Port of Genova*.
- Battery electric buses for Public transport: a methodological approach and results on energy consumption at different temperatures. **Data analysis** on fleet monitoring by *Gruppo Torinese Trasporti*.
- Thresholds conditioning scalability of electric vehicles: application of **queueing theory** in **Matlab** at public charging stations.
- Large-scale mobility pattern analysis and powertrain optimization. Processed **200k-vehicle European dataset** using **Python/ Pandas** to identify urban/extra-urban driving cycles. Developed **k-means clustering** model grouping vehicles by usage patterns (15+ features), enabling targeted powertrain redesign. Data provided by *Stellantis*

Contract Professor 09/2022 - 03/2025

- Taught **115+ hours of frontal classes** on Fluid Machinery, Model Based System Engineering and Transportation Systems in **MSc courses** of Mechanical and Civil Engineering.
- **Supervised 20+ MSc students** for their final thesis in Mechanical, Civil, Energetics or Aeronautical Engineering.

Peer Review Activities 2022 - present

- **AIIT TIS Conference Rome 2022** (Transport Infrastructure & Systems)
- **AIIT TIS Conference Rome 2024** (Next-Gen Mobility Systems)
- **SAE Conference Torino 2024** (CO_2 Reduction Technologies)

Università della Calabria

Contract Professor 07/2024

- Delivered course titled "Theory and Numerical Applications through Direct Data Collection from Vehicles" as part of the **postgraduate II level Master's program** in Electric Mobility and Circular Economy (MEES)

Blue Engineering S.p.A. & Politecnico di Torino

Research Scholar 07/2021 - 11/2021

- Conducted comprehensive analysis on advanced design and maintenance strategies for commuter rolling stock. Employed **Reliability Centered Maintenance (RCM)** principles to develop recommendations for implementing **predictive maintenance techniques** with **data-driven approaches** to improve operational efficiency. Delivered a **detailed technical report** synthesizing findings.

Alstom S.A., Savigliano (Italy)

Process Engineering Intern 09/2020 - 03/2021

- Implemented **Process FMECA (PFMECA)** for Coradia Stream regional train validation, conducting **fault tree analysis** on 15+ critical subsystems. Developed **statistical process control** protocols improving testing efficiency. Collaborated with cross-functional teams to establish **risk priority number (RPN)** matrices for 200+ components, enhancing system reliability metrics.

Team PACE @PoliTo

Additive Manufactoring Designer 09/2017 - 10/2018

- Our international team, comprising students from Politecnico di Torino, Tongji and Hunan Universities (China), TU Darmstadt and RWTH Aachen (Germany), and Kookmin University (South Korea), secured *First Place in Engineering and Industrial Design* at the 19^{th} PACE Forum competition held in Warren, Michigan, USA. More here: PACE - Partners for the Advancement of Collaborative Engineering Education.

Publications and Proceedings

Journal Publications

2024 Ferrari A., **Gurrì S.**, Vento O.*, ***Injected Fuel Mass and Flow Rate Control in Internal Combustion Engines: A Systematic Literature Review***, *Energies* - 2024, Publication here: DOI

2024 Olivari E., **Gurrì S.**, Caballini C.*, Carotta T.,Dalla Chiara B., ***Ports go green: an energy-based cost analysis for evaluating the electrification of yard tractors***, *The Open Transportation Journal* - 2024, Publication here: DOI

2023 **Gurrì S.***, Bocchieri M., Galasso D., Operti V., Dalla Chiara B., ***Assessing the speed of an electric multiple-unit freight train on high-speed lines***, *Ingegneria Ferroviaria* - 2023, Publication here: DOI

Conference Contributions

2024 **Gurrì S.***, Zara G., Di Paola A., Dalla Chiara B., ***Design of an integrated monitoring system for multiple-unit freight trains***, *6th International Conference on Railway Technology*, September 1-5, 2024 (Prague) - Publication here: DOI

2024 **Gurrì S.**, Cappelli F.*, Dalla Chiara B., ***Matching demand and supply in motorised mobility via data analysis***, *SIDT Conference*, June 12-15, 2024 (Villasimius) - no proceedings

2024 **Gurrì S.***, Olivari E., Caballini C., Dalla Chiara B., ***Next-generation freight intermodal trains: an effective way to increase rail share and sustainability of inland transportation***, *SIDT Conference*, June 12-15, 2024 (Villasimius) - no proceedings

2023 **Gurrì S.***, Zara G., Di Paola A., Dalla Chiara B., ***Preliminary design of an integrated monitoring system for multiple-unit freight trains***, *UIC high speed rail - 07-10 March 2023 Marrakesh*, March 07-10, 2023 (Marrakesh) - no proceedings

2022 **Gurrì S.***, Santacaterina E., Guarrera M., Dalla Chiara B., ***Driving modal shift on low-traffic railway lines through technological innovation***, *Transportation Research Procedia - AIIT International Conference TIS*, September 15-16, 2022 (Rome) - Publication here: DOI

2022 **Gurrì S.***; Bocchieri, M.; Galasso, Daniela; Operti, V.; Dalla Chiara, B., ***Simulating the operation of new-generation freight-EMUs for high-speed lines: perspectives for more reliable, sustainable, and fast logistics***, *5th International Conference on Railway Technology*, August 22-25, 2022 (Montpellier) - Publication here: DOI

Under Review

2025 Vento O., **Gurrì S.***, Ferrari A., ***A Methodology for Boundary Condition Optimization in CFD of Internal Combustion Engines***

2025 **Gurrì S.**, Flavio C.*, Dalla Chiara B., ***Matching demand and supply in motorised mobility: a data-driven proposal for an urban-differentiated driving cycle***

2025 Olivari E., **Gurrì S.***, De Marinis F., Caballini C., ***Nested Discrete Event Simulation and Microsimulation Approach for Multicriteria Analysis of Intermodal Transportation: an application to Next-Generation Freight Trains***

Dissemination

2023 Dalla Chiara, B.; Gurrì, S., ***Efficienza energetica nel trasporto merci: quali strumenti.***, *Logistica Management, pp 54-61* - March 2023

Hard skills

CFD solvers	Converge CFD, GT Power
CAD software	Solidworks, Inventor, Autocad 2D, NX11
Discrete Event Simulation	Arena, Anylogic
Railway Microsimulation	OpenTrack, Trenissimo
Coding and data analysis	Python, Matlab, Excel
Others	HPC systems (MPI, OpenMP)

Courses and Certifications

2024 **Dive into the World of HPC: Parallel and Accelerated Computing**
80 hours, *CINECA*

2023 **Towards Data Analysis and Machine Learning – Data Structures in Python (Advanced Level)**
40 hours, *Politecnico di Torino*

2021 **Railway Engineer Course – Organization, Technics, and Safety in the Railway Field**
60 hours, *CIFI*

2021 **Graduate Record Examination (GRE) – General Test**
ETS

2019 **TFI – Test de Français International**
ETS EMEA

2018 **CSWA – Certified SOLIDWORKS Associate in Mechanical Design**
SolidWorks Authorized Training Centre

Hobbies and ice breakers

Outdoor pursuits	Hiker and runner, with forays into mountain biking. Balancing physical challenges with mindful practices like yoga, embracing both the thrill of exploration and moments of tranquility in nature
Storytelling	Amateur photographer of urban and natural landscapes, capturing the interplay of light and shadow. Combining environmental portraiture with creative writing to craft compelling narratives.
Continuous learning	Voracious reader of essays and psychological literature. Actively engaged in online courses on emerging technologies, bridging theoretical knowledge with practical applications