

# Fabrizio Donati

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## SUMMARY

Proactive lead scientist with a focus on data-driven modelling with 10+ years experience in C++ and Python. Skilled in developing, implementing, and assessing multi-disciplinary simulations, with a strong ability to understand risks and limitations and optimize performance. My methodology includes collaborating with diverse teams, incorporating a deep knowledge of mathematical and statistical concepts into a practical strategy. This ensures that my models are not just theoretically robust but also applicable to real-life situations and capable of offering actionable insights.

## EXPERIENCE

### Senior Simulation Development Engineer

Feb 2017 - Current

*Stake F1 Team, Hinwil, Switzerland*

- Responsible for the mathematical modeling and software development of the main vehicle simulation tools including lap time simulations and telemetry data-driven replays, as part of the Vehicle Performance Team.
- Implemented C++ finite difference schemes for discretizing vehicle dynamics equations in the proprietary software car model from scratch, introducing solutions for high accuracy and high frequency applications.
- Optimized performance by leveraging OpenMP to successfully parallelize the C++ codebase, achieving a 5x speed-up in data loading and processing to integrate the original car model into a driver-in-the-loop simulator.
- Developed a full-stack, Newton-Raphson gradient descent-based simulation software using .NET framework, C#, WPF, and XAML, enabling car setup optimization and improving race engineers' pre-event procedures.
- Partnered with trackside engineers to streamline tools development for race preparation and post-event analysis, leading GUI and C++ code development for car setup scans and pit lane/race start simulations.
- Leveraged Python to extract, transform and integrate GPS, tyre and lap time data across all competitor race events. Used cleaned data to fuel regression simulations for deriving key metrics to rank engine performances.
- Designed a Gaussian kernel-based method to integrate wind contributions into vehicle model calculations, guided by feedback from Formula 1 drivers Valtteri Bottas and Guanyu Zhou. This advancement allowed drivers to virtually experience wind gusts during simulator sessions, optimizing their driving trajectories.
- Formulated and executed power unit model modifications to the car model to explore the impact of the FIA F1 2026 regulation changes, providing insights through simulation results to the Technical Director.

### Software Engineer

Jan 2023 - Jun 2023

*Meta Reality Labs (via Qualitest Group), Zurich, Switzerland*

- Developed software solutions for the high-end mixed reality headset Meta Quest Pro by Reality Labs.
- Reduced waiting time between reading and rendering phases in a proprietary AndroidOS virtual reality application, by implementing reader-writer locks using the C++ `std::mutex` library.
- Enhanced the reliability of the system by developing JavaScript automated quality assurance end-to-end tests for camera stability, image reconstruction and dynamic range adjustment.
- Automated testing for a novel 3D graphics mixed reality occlusion feature in an in-house AndroidOS application, by devising a C++ solution using OpenGL for virtual object rotation control.

### Doctoral Researcher

Jan 2012 - Jun 2016

*King's College London, London, United Kingdom*

- Conducted cardiovascular modelling within a biomedical research group at St. Thomas' Hospital.
- Enhanced understanding of aortic stenosis and improved patient stratification by engineering a data-driven method for robust and accurate human aortic pressure estimation from medical imaging data. The solution was implemented in Fortran and C++, and simulation results from real patients' data visualized in MATLAB.
- Filed the proposed method in a patent published under the Patent Cooperation Treaty (PCT) in 2017.
- Embedded a simplified computational fluid dynamics solver in the proprietary multiphysics human heart simulation software, enabling the representation of complex heart dynamics within clinically feasible timelines.

### Teaching Assistant

Oct 2010 - Sep 2011

*Politecnico di Torino, Torino, Italy*

- Supervised postgraduate students for the course "Numerical simulations of turbulent flows".

### Student Researcher

Oct 2008 - Sep 2011

*Politecnico di Torino, Torino, Italy*

- Proposed a cost-efficient multidimensional turbulence filter for large-eddy computational fluid dynamics simulations, maintaining accurate resolution and representation of primary flow field characteristics.
- Implemented spectral filtering algorithms in Fortran and used open-source scientific visualization software VisIt for analyzing turbulent structures and statistics, including vorticity to stretching-tilting correlations.
- Examined Reynolds number impacts through autonomously configured synthetic jet aerodynamic experiments.

## EDUCATION

### Master of Science (MSc) in Financial Engineering

Dec 2023 – Ongoing

*World Quant University, New Orleans, United States*

- Pursuing a specialized course focusing on statistics evaluation and econometric modeling, equipping with advanced industry-wide skills for high-demand roles in securities, banking, and financial management.
- Training as a quantitative analyst and developing proficiency in presenting ideas and concepts effectively in a professional business environment.

### Doctor of Philosophy (PhD) in Biomedical Engineering

Feb 2012 - Jun 2016

*King's College London, London, United Kingdom*

- Major: Imaging Sciences.
- Thesis: Non-invasive relative pressure estimation using cardiovascular magnetic resonance.

### Master of Science (MSc) in Aerospace Engineering

Apr 2009 - Dec 2011

*Politecnico di Torino, Torino*

- Major: Numerical Aerodynamics.
- Thesis: In silico study on isotropic turbulence and the effects of multidimensional spectral filtering.

### Bachelor of Science (BSc) in Aerospace Engineering

Oct 2004 - Mar 2009

*Politecnico di Torino, Torino*

- Major: Aeronautical Engineering.
- Thesis: Experimental investigation on axisymmetric synthetic jet with Reynolds number 18000.

## CERTIFICATIONS & QUALIFICATIONS

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| • Supervised Machine Learning: Regression and Classification (Coursera). | 2023 |
| • Mastering Data Structures and Algorithms using C and C++ (Udemy).      | 2020 |
| • C++ Advanced Topics (Coursera).  | 2019 |
| • Parallel Computing with CUDA (Pluralsight).                            | 2019 |
| • Google Developer Challenge Scholarship (Google).                       | 2017 |

## PATENTS

- Method and system for pressure drop estimation ([WO2017158343A1](#)) 2017
- Method and system for estimating the blood pressure drop through a blood vessel based on measurements of velocity obtained from various medical imaging modalities.

## HONORS & AWARDS

### VPH Travel Award

2014

*Virtual Physiological Human Institute*

- Recognized for exceptional contributions to cardiovascular modeling research and best interactive poster presentation at the Virtual Physiological Human Institute 2014 conference in Trondheim, Norway.

## SKILLS

C++, C, Python, MATLAB, C#, SQL, OpenGL, OpenMP, Machine Learning, Parallel Programming, Git, Mercurial, Subversion, CMake, Buck, Azure DevOps Services, Big Data, Mathematical Modelling, Numerical Methods, Non-Linear Optimization, Driver-In-the-Loop Simulations, Image Processing, Collaboration, Strategic Thinking, Communication Skills, Analytical Skills, Creativity, Time Management, Empathy.

## SCIENTIFIC PUBLICATIONS

- [Beyond Bernoulli: improving accuracy and precision of non-invasive peak pressure drops](#). Donati, Myerson, Bissell, Smith, Neubauer, Monaghan, Nordsletten, Lamata. *Circulation: Cardiovascular Imaging*, American Heart Association (2017).
- [Non-invasive pressure difference estimation from PC-MRI using the work-energy equation](#). Donati, Figueroa, Smith, Lamata, Nordsletten. *Medical Image Analysis*, Elsevier (2015).
- [Pressure mapping from flow imaging: enhancing computation of the viscous term through velocity reconstruction in near-wall regions](#). Donati, Nordsletten, Smith, Lamata. 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (2014).

## LANGUAGES

Italian (native), English (professional), French (basic).