CURRICULUM VITAE
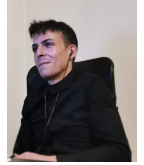
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Channels: LinkedIn - X (Twitter) - YouTube

1   CAREER SUMMARY

I am currently postdoctoral fellow at The University of Sydney, School of Civil Engineering (Australia). I studied at the School of Mechanical Engineering of the University of Florence (Italy) and did my thesis jointly at Ecole des Ponts ParisTech and Ecole Centrale de Nantes (France), in collaboration with the University of Versailles and St-Quentin and the enterprise Ingerop.

1.1   Scientific interest and research axes

Data-driven – Thermodynamics-/physics-informed machine learning – Computational mechanics – Multiscale modelling – Structural Mechanics – Masonry – Fast Dynamics – Blast loads – Rocking systems.

2   EMPLOYMENT

12/2022 – present	**Postdoctoral researcher**, SciGEM, School of Civil Engineering, The University of Sydney. Australia.
01/2021 – 11/2022	**Post-doctoral researcher**, ERC-StG CoQuake project, Centrale de Nantes, GeM Laboratory. France.
11/2020 – 12/2020	**Research Engineer** Centrale de Nantes – Centrale Innovation, France.
09/2017 – 10/2020	**Engineer**, Ingérop Conseil et Ingénierie, France.
06/2016 – 10/2016	**Research Engineer**, Ecole des Ponts ParisTech, France.

3   ACADEMIC DEGREES

10/2017 – 12/2020	**PhD**, Mechanics − Ecole Centrale de Nantes, Ecole des Ponts ParisTech in collaboration with USVQ and Ingerop, France. Supervisors: I Stefanou, P Vannucci.
01/2016 – 07/2017	**Master**, Mechanical Engineering, University of Florence, Italy (solemn commendation).
10/2013 – 12/2015	**Bachelor**, Mechanical Engineering, University of Florence, Italy.

4   HONOURS AND AWARDS

2022   Early Career Researcher Award by EUROMECH (European Mechanics Society) on the occasion of the 18th European Mechanics of Materials Conference, Oxford, UK.

2021   Award for the best PhD thesis bringing technological and conceptual breakthroughs in the industry by Centrale Innovation (Ecoles Centrales Group).

2021   Award for the best PhD by CSMA (Computational Structural Mechanics Association).

2017   Award for the best Master thesis by the Order of Engineers of Florence, Italy.

5   SCIENTIFIC PRODUCTION

Author of **12 articles** in major multi-disciplinary scientific journals and leading peer-reviewed international journals, **two chapters**, and **28 communications/posters** in international and national conferences.

All contributions, except for [16], are freely available via open-science platforms (HAL and arXiv), indicated by their url address, whenever not freely available at the provided DOI. The access to [16] is restricted as classified *Confidentiel Défense*.

5.1   Refereed journal articles

[1]   **F Masi** and I Einav. "Neural integration for constitutive equations using small data". In: *Comput Methods Appl Mech Eng* 420 (2024), p. 116698. DOI: 10.1016/j.cma.2023.116698.

[2]   **F Masi** and I Stefanou. "Evolution TANN and the identification of internal variables and evolution equations in solid mechanics". In: *J Mech Phys Solids* 174 (2023). DOI: 10.1016/j.jmps.2023.105245. URL: https://arxiv.org/abs/2209.13269.

[3]   **F Masi** and I Stefanou. "Multiscale modeling of inelastic materials with Thermodynamics-based Artificial Neural Networks (TANN)". In: *Comput Methods Appl Mech Eng* 398 (2022), p. 115190. DOI: 10.1016/j.cma.2022.115190. URL: https://arxiv.org/abs/2108.13137.

[4]   **F Masi**, I Stefanou, and V Maffi-Berthier. "Scaling laws for rigid-body response of masonry structures under blast loads". In: *J Eng Mech (featured in the Editor's Choice section)* 147.10 (2021), p. 04021078. DOI: 10.1061/(ASCE)EM.1943-7889.0001986. URL: https://arxiv.org/abs/2012.09494.

[5]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Berthier. "Thermodynamics-based Artificial Neural Networks for constitutive modeling". In: *J Mech Phys Solids* 147 (2021), p. 104277. DOI: 10.1016/j.jmps.2020.104277. URL: https://arxiv.org/abs/2005.12183.

[6]   **F Masi**, I Stefanou, V Maffi-Berthier, and P Vannucci. "A Discrete Element Method based-approach for arched masonry structures under blast loads". In: *Eng Struct* 216 (2020), p. 110721. DOI: 10.1016/j.engstruct.2020.110721. URL: https://hal.science/hal-02320696v2.

[7]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Berthier. "Resistance of museum artefacts against blast loading". In: *J Cul Her* 44 (2020), pp. 163–173. DOI: 10.1016/j.culher.2020.01.015. URL: https://hal.science/hal-02320029.

[8]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Berthier. "Rocking response of inverted pendulum structures under blast loading". In: *Int J Mech Sci* 157-158 (2019), pp. 833–848. DOI: 10.1016/j.ijmecsci.2019.05.024. URL: https://hal.science/hal-02132167.

[9]   P Vannucci, **F Masi**, and I Stefanou. "A nonlinear approach to the wind strength of Gothic Cathedrals: The case of Notre Dame of Paris". In: *Eng Struct* 183 (2019), pp. 860–873. ISSN: 0141-0296. DOI: https://doi.org/10.1016/j.engstruct.2019.01.030. URL: https://hal.science/hal-01458767v5.

[10]   **F Masi**, PM Mariano, and P Vannucci. "Blast actions in aircrafts: An integrated methodology for designing protection devices". In: *Eng Struct* 175 (2018), pp. 895–911. DOI: 10.1016/j.engstruct.2018.08.082. URL: https://hal.science/hal-01720002v2.

[11]   **F Masi**, I Stefanou, and P Vannucci. "A study on the effects of an explosion in the Pantheon of Rome". In: *Eng Struct* 164 (2018), pp. 259–273. DOI: 10.1016/j.engstruct.2018.02.082. URL: https://hal.science/hal-01493006v2.

[12]   **F Masi**, I Stefanou, and P Vannucci. "On the origin of the cracks in the dome of the Pantheon in Rome". In: *Eng Fail Anal* 92 (2018), pp. 587–596. DOI: 10.1016/j.engfailanal.2018.06.013. URL: https://hal.science/hal-01719997v3.

5.2   Book chapters

[B1]   **F Masi**. "Introduction to regression methods". In: *Machine Learning in Geomechanics, vol. I (in press – postprint)*. Ed. by I Stefanou and F Darve. Wiley, ISTE, 2024.

[B2]   **F Masi** and I Stefanou. "Physics-informed and thermodynamics-based artificial neural networks for constitutive modeling". In: *Machine Learning in Geomechanics, vol. II (in press – postprint)*. Ed. by I Stefanou and F Darve. Wiley, ISTE, 2024.

5.3   Reviewed international conferences

[C1]   Ahmad Morsel, **F Masi**, I Stefanou, P Kotronis, G Racineux, and E Marché. "Reduced-scale testing of masonry structures to explosions". In: *9th International Conference on Structural Engineering and Concrete Technology: ICSECT 2024, London, United Kingdom, April 14 – 16 (Accepted – in press)*. Springer International Publishing, 2024. DOI: TBA.

[C2]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Berthier. "Material modeling via thermodynamics-based artificial neural networks". In: *Geometric Structures of Statistical Physics, Information Geometry, and Learning: SPIGL '20, Les Houches, France, July 27–31*. Ed. by F Barbaresco and F Nielsen. Springer International Publishing, 2021, pp. 308–329. DOI: 10.1007/978-3-030-77957-3_16.

[C3]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Berthier. "Response of monumental buildings to internal explosions". In: *Proceedings of the 7th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2019), Papadrakakis, Fraiadakis (eds), Crete, Greece*. 2019, pp. 24–26. DOI: 10.7712/120119.6958.19630.

[C4]   **F Masi**, I Stefanou, P Vannucci, and V Maffi-Bertier. "Rocking response and overturning of museum artefacts due to blast loading". In: *7th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2019), Papadrakakis, Fraiadakis (eds), Crete, Greece*. 2019, pp. 24–26. DOI: 10.7712/120119.7119.19577.

5.4 Other international publications

[P1]   A Morsel, **F Masi**, I Stefanou, P Kotronis, G Racineux, and E Marché. "Reduced-scale testing of masonry structures to explosions (poster)". In: *34th Workshop ALERT Geomaterials, Aussois, France.* 2023.

[P2]   A Morsel, **F Masi**, I Stefanou, and P Kotronis. "Design of reduced-scale experiments of masonry structures subjected to blast loads (poster)". In: *33rd Workshop ALERT Geomaterials, Aussois, France.* 2022.

[P3]   **F Masi** and I Stefanou. "Thermodynamics-based Neural Networks: a general framework for modeling microstructured materials displaying path-dependency (poster)". In: *32nd Workshop ALERT Geomaterials, Aussois, France.* 2021.

[P4]   F Rabie, **F Masi**, and I Stefanou. "Thermodynamics-based Artificial Neural Networks for Nonlinear Seismic Analysis of High-rise Buildings (poster)". In: *32nd Workshop ALERT Geomaterials, Aussois, France.* 2021.

5.5 Reviewed national conferences

[N1]   **F Masi** and I Stefanou. "Réseaux de neurones artificiels basés sur la thermodynamique (TANN) pour la mécanique computationnelle et la modélisation multi-échelle". In: *25eme Congrès Français de Mécanique (CFM), Nantes, France (short version of [0] submitted as application to Paul Germain Prize, organized by Association Française de Mécanique).* 2022.

[N2]   **F Masi**, I Stefanou, A Morsel, and P Kotronis. "Reduced-scaled experiments of masonry structures under blast loads". In: *25eme Congrès Français de Mécanique (CFM), Nantes, France.* 2022.

[N3]   G Piunno, **F Masi**, I Stefanou, and C Jommi. "Multi-scale modelling of natural composites via Thermodynamics-based Artificial Neural Networks". In: *25eme Congrès Français de Mécanique (CFM), Nantes, France.* 2022.

[N4]   **F. Masi**, I. Stefanou, P. Vannucci, and V. Maffi-Berthier. "A Discrete Element Method approach for the preservation of the architectural heritage against explosions". In: *12th HSTAM International Congress on Mechanics.* Thessaloniki, Greece, 2019.

5.6 Research reports

[13]   **F Masi**. "Fast-dynamic response and failure of masonry structures of non-standard geometry subjected to blast loads". PhD thesis. École centrale de Nantes, 2020. URL: https://theses.hal.science/tel-03217357.

[14]   P Vannucci, I Stefanou, et al. *Structural integrity of Notre Dame Cathedral after the fire of April 15th, 2019.* Tech. rep. Paris: UVSQ-ENPC, 2019. URL: https://hal.archives-ouvertes.fr/hal-02105786v2.

[15]   P Vannucci, **F Masi**, et al. *A comparative study on the effects of blast actions on a monumental structure.* Tech. rep. Paris: UVSQ-ENPC, 2017. URL: https://hal.science/hal-01720557.

[16]   P Vannucci, I Stefanou, et al. *Cathédrales Durables (classified: Confidentiel Défense).* Tech. rep. Paris: CNRS, 2017.

5.7 Invitations to workshop and seminars

2023 Invited lecture, "Physics-based neural constitutive equations," Hybrid Computational Methods in Geotechnics, The University of Melbourne, Australia, 27 Apr 2023.

2023 Invited lecture, *IA: Approches et intérêt pour l'étude des CMC – Atelier,* Groupement de Recherche (CMC)^2, ENS Paris-Saclay, 17 Mar 2023.

2022 Invited lecture, ISSMGE TC309 Technical Forum of Young Scholars on Data-driven Modelling of Soil Behaviours with Geotechnical Applications, Hong Kong Polytechnic University, 25 Nov 2022.

2022 Invitation to workshop. "*Deep learning, simulation temps réel et réduction de modèles,*" "5e Workshop Computational Structural Mechanics Association (CSMA) Junior". Giens, France, 14-16 May 2022.

2021 Invited lecture, Crunch Machine Learning + X Seminars, Brown University, Division of Applied Mathematics, 12 Nov 2021.

2021 Invited lecture, Data-centric engineering, The University of Sydney, 27 Oct 2021.

5.8 Software development

– **TANN** "Thermodynamics-based Artificial Neural Networks"
github.com/filippo-masi/Thermodynamics-Neural-Networks
A compilation of Python scripts that implement Thermodynamics-based Artificial Neural Networks (TANN) at the material point level, see [5]. The collection encompasses datasets, data pre-processing, and TANN training utilising the Tensorflow and PyTorch libraries

– **DLworkshop** "Workshop on Deep Learning and constitutive modelling"
github.com/filippo-masi/CSMA-Workshop-in-Deep-Learning
A comprehensive repository containing all relevant materials, codes, and presentations from the 5th workshop of CSMA Junior (Computational Structural Mechanics Association) held in Porquerolles Island, France, on 14-15 May 2022. Targeted at young scholars, it provides Python scripts and Jupyter notebooks for differentiating between black-box and physics-based approaches for material modelling and explains the bases to build artificial neural networks for constitutive modelling via tutorials and benchmarks of increasing difficulty.

– **TANN-multiscale** "Multiscale modeling of inelastic materials with TANN"
github.com/filippo-masi/TANN-multiscale
The repository collects Python scripts necessary for the validation of the benchmarks presented in [3] and is composed of two parts. The former is the implementation of a Finite Element code for simulating the response of lattice materials and structures, under several type of prescribed boundary conditions (periodic, Neumann, Dirichlet). The latter is a hands-on for performing Finite Element analyses using TANN as a user-material, relying on the open-source platform FEniCS.

– **Hands-on-REG** "Hands-on Introduction to regression methods"
github.com/alert-geomaterials/2023-doctoral-school/main/chapters/hands-on/C02
Hands-on examples and exercises from ALERT Geomaterials Doctoral School on "Machine Learning in Geomechanics" (2023), see [0].

– **Hands-on-PINN-TANN** "Hands-on physics-informed and thermodynamics-based neural networks"
github.com/alert-geomaterials/2023-doctoral-school/main/chapters/hands-on/C09
Hands-on examples and exercises from ALERT Geomaterials Doctoral School on "Machine Learning in Geomechanics" (2023), see [0].

– **NICE** "Neural Integration for Constitutive Equations"
github.com/filippo-masi/NICE
This library provides the implementation in PyTorch of the Neural Integration for Constitutive Equations (NICE) method and related benchmarks, see [1]. The algorithms in this repository are implemented using torch and torchdiffeq libraries.

6 SUPERVISION AND TEACHING

6.1 Supervision

– **PhD students**
AHMAD MORSEL (01/2021 – present) – PhD candidate, Ecole Centrale de Nantes. PhD in the frame of BLAST (Blast LoAds on STructures) – Connect Talent project, funded by Pays de la Loire and Nantes Metropole (PI Ioannis Stefanou). Subject: Experimental testing of masonry structures subjected to extreme loads. Amount of supervision: 30% (in collaboration with Ioannis Stefanou and Panagiotis Kotronis). Significance of the work: Through this research, a unique platform for performing reduced-scale experiments of structures under blast loads is being designed. The experiments will convey valuable information for current state-of-the-art knowledge in modelling the fast-dynamic response of blocky structures.

– **Master students**
ENZO LOUVARD (02/2024 – present) – Master intership at The University of Sydney, in collaboration with ENS Paris-Saclay. Subject: Neural constitutive equations for material model discovery from small data. Amount of supervision: 100%.
FARAH RABIE (02/2021 – 08/2021) – Master internship at Ecole Centrale de Nantes, in the frame of CoQuake (Controlling earthQuakes) – European Research Center (ERC) Starting Grant. Subject: Thermodynamics-based Artificial Neural Networks for nonlinear seismic analysis of high-rise buildings. Amount of supervision: 60% (in collaboration with Ioannis Stefanou). Significance of the work: This work

concerns the application of Thermodynamics-based Neural Networks to high-rise buildings, with a in-depth study of machine learning models (in particular deep Learning and model order reduction methods). The study proposed an alternative way to otherwise computationally expensive seismic analyses of civil infrastructures.

Barbara Abougaye (02/2020 – 08/2020). Master internship at Ecole Centrale de Nantes. Subject: Scaling laws for the material response under impact loading. Amount of supervision: 60% (in collaboration with Ioannis Stefanou). Significance of the work: During this internship, literature review and preliminary studies were carried on the derivation of scaling laws for the material behaviour under impact loading.

6.2 Teaching experience

- **Ecole des Ponts**
  Courses: Undergraduate "Computational Mechanics" and "Advanced Computational Mechanics" (2018-2020). Responsibilities: Conducting problem classes, grading midterm exams, and designing team projects for groups of four students.
- **Ecole Centrale de Nantes**
  Courses: Undergraduate "Continuum Mechanics" (problem solutions assistance) and Master's "Experimental Imaging Analysis for Engineers" (full responsibility, 2020 to 2023). Responsibilities: Preparing and delivering lectures and problem solutions, creating and grading exams.
- **ALERT Geomaterials Doctoral School**
  Courses: "Introduction to Regression Methods" and "Physics-Informed and Thermodynamics-Based Neural Networks" (2023). Theory lectures coupled with hands-on examples and exercises: github and alertgeomaterials.eu.

7 SERVICE

7.1 Responsibilities

- Invited reviewer for the following international scientific journals: Comput Mech – Comput Methods Appl Mech Eng – Def Technol – Exp Mech – Eur J Mech A Solids – Géotechnique – Int J Mech Sci – Int J Numer Anal Methods Geomech – Int J Numer Methods Eng – J Mech Phys Solids – Strain.
- Co-organizer of the Minisymposium entitled Scientific Machine Learning techniques for complex engineering systems on the occasion of the 2023 ECCOMAS Young Investigators Conference (YIC2023), held in Porto, Portugal (19-21 June, 2023).
- Member of the Direction Board of GeM laboratory, Ecole Centrale de Nantes (2022).
- Committee member of AustraliaN Association for GRAnular Media (ANAGRAM) (11/2023 – present)

7.2 Dissemination of scientific knowledge

2023 Coordinator of the "*Explosions, vibrations et patrimoine*" workshop (with Ahmad Morsel, Ioannis Stefanou, Panagiotis Kotronis, Guillaume Racineux, Emmanuel Marché), on the occasion of the 2023 edition of the *Nuit Blanche des Chercheur.es* event hosted by Nantes Université (short video).

2022 Blog on my PhD experience under the form of an interview to outreach young generations about academia, industry, and international exchanges, published by *Docteurs Sciences pour l'Ingénieur*.

2022 Since 2020, Ambassador of DECLICS Association: *Dialogues Entre Chercheurs et Lycéens pour les Intéresser à la Construction des Savoirs*.[1]

2021 Popularisation of part of the PhD thesis works in the French civil engineering magazine *Cahiers Techniques du Bâtiment (CTB)*, written by Stéphanie Obadia: "*Béton : quelle réaction face à l'explosion ?*", September, 2021.

2020 Webinar for a wide professional (civil engineering) public: "*Comportement des structures maçonnées à l'explosion*", Ingérop, 29 October, 2020.

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[1]Dialogues between researchers and high school students to interest them in the construction of knowledge.