

PERSONAL INFORMATION

Federico Califano

WORK EXPERIENCE

Oct 2025 - Present **Subject Expert (Cultore della Materia)**
Department of Structural and Geotechnical Engineering, Sapienza University of Rome – Rome, Italy

- Appointed as *Cultore della Materia* for courses in the area of Structural and Solid Mechanics (SSD ICAR/08).
- Member of examination boards, contributing to the assessment of students' knowledge.

Jan 2025 - Present **Research Fellow (Assegnista di Ricerca)**
Department of Structural and Geotechnical Engineering, Sapienza University of Rome - Rome, Italy

- Developing constitutive modeling approaches through neural networks, continuing the research initiated during the PhD in theoretical and applied mechanics.
- Exploring multimodal and language-based AI models to support and assess reasoning in solid mechanics.

Jan 2022 - Jan 2025 **PhD Fellow in Theoretical and Applied Mechanics**
Department of Mechanical and Aerospace Engineering, Sapienza University of Rome - Rome, Italy

- Supervisor: Prof. Jacopo Ciambella.
- **Research topics:** nonlinear viscoelasticity, constitutive modeling for filled elastomers, data-driven (neural network) constitutive models.

Teaching Experience

- Fall 2023: *Solid Mechanics* - Tutor, Environmental and Industrial Engineering, Sapienza University of Rome (Latina, Italy).
- Spring 2023: *Mechanics of Solids and Structures* - Tutor, Aerospace Engineering, Sapienza University of Rome (Rome, Italy).
- Spring 2023: *General Physics I* - Tutor, Environmental and Industrial Engineering, Sapienza University of Rome (Latina, Italy).
- Fall 2022: *Solid Mechanics* - Tutor, Environmental and Industrial Engineering, Sapienza University of Rome (Latina, Italy).
- Spring 2022: *General Physics I* - Tutor, Environmental and Industrial Engineering, Sapienza University of Rome (Latina, Italy).

Jan 2022 - May 2025 **Research Associate (PhD industrial collaboration)**
Bridgestone Technical Center Europe - Castel Romano (Rome), Italy

- Prepared internal technical reports on the experimental characterization of filled rubber (including dynamic and high-frequency tests), constitutive modeling of nonlinear viscoelasticity, and data-driven modeling techniques for soft materials.
- Conducted experimental campaigns at Bridgestone's R&D laboratories.
- Developed a Python library for parameter fitting of literature phenomenological models.
- Implemented three best-performing constitutive models in Abaqus via UMAT subroutines.
- Designed a data-driven rheological element (DRE) model, later protected by a European patent application.
- Included a six-month formal internship at Bridgestone Technical Center Europe.

Apr 2021 - Oct 2021 **Intern**
ENEA - Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile, Frascati (Rome), Italy

- Master's thesis internship on the conceptual design of a High-Temperature Superconducting (HTS) insert for the DTT fusion reactor's Central Solenoid.
- Developed analytical and numerical models for the electromagnetic and thermo-structural sizing of HTS coils under cryogenic operating conditions.
- Contributed to the optimization and validation of the insert design through finite element analyses (ANSYS APDL) and participation in the published IEEE study on the DTT HTS insert.

EDUCATION AND TRAINING

Jan 2022 - May 2025 **PhD in Theoretical and Applied Mechanics**
Sapienza University of Rome - Rome, Italy

- Thesis title: Advanced material modeling for virtual tire development.
- Supervisor: Prof. Jacopo Ciambella.

Oct 2021 **MSc in Mechanical Engineering**
Sapienza University of Rome - Rome, Italy

- Thesis: Sizing and verification of a High Field Superconducting Insert for the solenoid DTT fusion reactor plant.
- Supervisor: Prof. Giuseppe Ruta.
- Grade: 110 with honors (highest grade in the Italian system).

Dec 2018 **BSc in Mechanical Engineering**
Sapienza University of Rome - Rome, Italy

Grade: 110 with honors (highest grade in the Italian system)

2015 - 2020 **Scholar, Collegio Universitario dei Cavalieri del Lavoro "Lamaro Pozzani"**
Rome, Italy

- Admitted through a national public competition to College founded and managed by the National Federation of the Cavalieri del Lavoro, providing full board, lodging, and an interdisciplinary educational program.
- Scholarship renewed annually for five years based on academic excellence and participation in advanced cultural and leadership activities.
- Completed programs in economics, politics, and international relations, earning diplomas in *Culture for Business* (G. Marzotto) and *Global Studies: Politics, Economics, and Culture*.
- The College's mission is to cultivate young leaders through rigorous academic and cultural enrichment, fostering curiosity, critical thinking, and civic responsibility.

Jul 2015 **Scientific High School Diploma (Liceo Scientifico "Ettore Majorana")**
Latina, Italy

Final grade: 100/100.

HONORS AND AWARDS

Mar 2015 **Third Place – XIX National Programming Contest “Macchina di Turing”**
Università di Pisa – Award received during high school (Liceo Scientifico “Ettore Majorana”, Latina, Italy).

Apr 2014 **Second Place – XVIII National Programming Contest “Macchina di Turing”**
Università di Pisa – Award received during high school (Liceo Scientifico “Ettore Majorana”, Latina, Italy).

Feb 2013 **First Place – XVII National Programming Contest “Macchina di Turing”**

Università di Pisa – Award received during high school (Liceo Scientifico “Ettore Majorana”, Latina, Italy).

**SCIENTIFIC CONFERENCES
AND PRESENTATIONS
(PRESENTING AUTHOR
MARKED WITH *)**

Sep 2025 **Modeling the Payne Effect in Elastomers through Deep Rheological Elements**
Califano, Federico*, Domesi, S., Ciambella, Jacopo. Oral Presentation: YIC2025 - 8th ECCOMAS Young Investigators Conference, Pescara, Italy.

Sep 2025 **A Deep Rheological Element for Modeling Large-Strain Viscoelasticity in Elastomers**
Califano, Federico*, Ciambella, Jacopo. Oral Presentation: COMPLAS 2025 – XVIII International Conference on Computational Plasticity, Barcelona, Spain.

Sep 2024 **Enforcing Physics in Hyperelasticity Modeling Using Kolmogorov-Arnold Networks**
Califano, Federico*, Ciambella, Jacopo. Oral Presentation: AIMETA 2024, Naples, Italy.

Jul 2024 **Constitutive Modeling of Hyperelasticity using Kolmogorov-Arnold Networks (KANs)**
Califano, Federico*. Oral Presentation: GIMC SIMAI YOUNG 2024, Naples, Italy.

Jul 2023 **Integrating Neural Networks into the Parallel Rheological Framework for Improved Constitutive Modeling of Elastomers**
Califano, Federico*, Ciambella, Jacopo. Oral Presentation: GIMC GMA GBMA 2023 – Università Mediterranea di Reggio Calabria, Italy.

May 2023 **On the Parallel Rheological Framework and its Capability of Predicting the Low-Frequency Behavior of Filled Rubber**
Califano, Federico*, Ciambella, Jacopo. Poster: RubberCon 2023 – University of Edinburgh, Scotland.

**SCIENTIFIC SERVICE AND
CONFERENCE ORGANIZATION**

Sep 2025 **Organizer and Chair**
Session MS009A “Advances in Modeling and Applications of Viscoelastic Soft Materials”, YIC2025 – 8th ECCOMAS Young Investigators Conference, Pescara, Italy.

**COURSES AND SUMMER
SCHOOLS**

Sep 2024 **XLIX Scuola Estiva di Matematica**
Gruppo Nazionale di Fisica Matematica - Ravello, Italy

Aug 2024 **Exploration and Design of Materials Across the Scales**
Dresden Center for Computational Materials Science (DCMS), Dresden Center for Intelligent Materials (DCIM), and D³ Research Training Group 2868 - Dresden, Germany

May 2024 **Advanced School on Applied Machine Learning**

The Abdus Salam International Centre for Theoretical Physics - Trieste, Italy

Sep 2023 XLVIII Scuola Estiva di Matematica

Gruppo Nazionale di Fisica Matematica - Ravello, Italy

Oct 2022 Soft Mechanics and Instabilities

Profs. Paola Nardinocchi & Giuseppe Ruta, Department of Structural and Geotechnical Engineering, Sapienza University of Rome - Rome, Italy

Oct 2022 CISM-ECCOMAS Summer School on Data-Driven Mechanics: Constitutive Model-Free Approach

International Centre for Mechanical Sciences - Udine, Italy

Sep 2022 XLVII Scuola Estiva di Matematica

Gruppo Nazionale di Fisica Matematica - Ravello, Italy

Jul 2022 Summer Graduate School "Mathematics of Machine Learning"

INdAM/SMI/MSRI/Courant Institute - Cortona, Italy

Apr 2022 EXPOSTID Expost Italian Diplomacy - Spring School 2022

Dipartimento SPGI, Università di Padova & Dipartimento di Scienze Politiche, Università di Roma Tre - Padova, Italy

Feb 2022 Hands-on Continuum Mechanics with COMSOL

Prof. Luciano Teresi, Università di Roma Tre - Rome, Italy

PUBLICATIONS AND PATENTS

- [1] Federico Califano and Jacopo Ciambella. "Enhancing Nonlinear Viscoelastic Modeling of Elastomers through Neural Networks: A Deep Rheological Element". In: *Mechanics of Materials* (Elsevier) (2026).
- [2] Federico Califano and Jacopo Ciambella. "Viscoplastic Simple Shear at Finite Strains". In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* (2023).
- [3] Lorenzo Giannini, Luigi Muzzi, Giuseppe Celentano, Aldo Di Zenobio, Lorenzo Zoboli, Gherardo Romanelli, Simonetta Turtu, Gianluca De Marzi, Antonio Corte, and Federico Califano. "Conceptual Design Studies of an HTS Insert for the DTT Central Solenoid". In: *IEEE Transactions on Applied Superconductivity* (2022).
- [4] Federico Califano and Jacopo Ciambella. "Enforcing Physics in Hyperelasticity Modeling Using Kolmogorov–Arnold Networks". Submitted to Proceedings of AIMETA 2024, XXVI Congresso AIMETA, Napoli, Italy, September 2–6, 2024 (Springer). 2024.
- [5] "Methods and devices for determining the stress response of a viscoelastic material". European Patent Application No. 24203500.4. Priority date: 30 September 2024. 2024.