



# Jérémy Bleyer

Chercheur Ecole des Ponts ParisTech, Laboratoire Navier  
Ingénieur des Ponts, des Eaux et des Forêts  
Professeur chargé de cours à l'École Polytechnique

May 7, 2024

Born on July 15<sup>th</sup> 1988 in Mulhouse, France

Researcher at Laboratoire Navier

École des Ponts, Université Gustave Eiffel, CNRS, Marne-la-vallée, France

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## Curriculum

- Jan 2017 – now** Researcher at Laboratoire Navier, ENPC, Univ Gustave Eiffel, CNRS, UMR 8205
- Jan 2016 – Dec 2016** Postdoctoral researcher at Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Sep 2012 – Dec 2015** PhD from Université Paris-Est, *Numerical methods for the yield design of civil engineering structures*, supervised by Patrick de Buhan at Laboratoire Navier
- Sep 2010 – now** Engineer of *Corps des Ponts, des Eaux et des Forêts*

## Teaching

- Nov 2022 – July 2023** Scientific Director of the Executive Master *Digital Twins for Complex Infrastructures and Urban Ecosystems*
- Sep 2020 – now** Part-time Associate Professor at École Polytechnique, Mechanical Engineering Department
- Sep 2017 – now** Associate Professor at École des Ponts ParisTech, Civil Engineering Department
- Sep 2011 – Sep 2017** Teaching Assistant at École des Ponts ParisTech

## Education

- present** HDR, in preparation
- Sep 2012 – Dec 2015** PhD from Université Paris-Est
- Sep 2010 – Sep 2012** École des Ponts ParisTech, Engineering degree, Civil Engineering Department
- Sep 2010 – Sep 2011** Master of Science, Mechanics of Materials and Structures (ENPC, Université Paris-Est) with highest honors
- Sep 2007 – Sep 2010** École Polytechnique, Engineering degree, Mechanical Engineering Department

## Honors and awards

- 2023 Jean Mandel Prize**
- 2017 Paul Germain PhD award** Finalist
- 2016 ECCOMAS PhD award** Finalist
- 2016 CSMA PhD award** Finalist
- 2016 PhD award** Delivered by Université Paris-Est
- 2016 PhD award** Delivered by École des Ponts ParisTech
- 2010 Medal L.E. Rivot** Delivered by the French Academy of Sciences: "*particular interest for scientific research and quality of work in the domain of mechanical and computational sciences*"

## Scientific supervision

### PhD students

- 2023-now **Alice Gribonval**, *Modeling of 3D-printed concrete structures*, advisor Karam Sab, industrial collaboration with XtreeE
- 2023-now **Giulia d’Orio**, *Reinforced concrete behavior for modeling and safety of nuclear civil engineering structures*, advisor Arthur Lebée, industrial collaboration with EDF R& D
- 2023-now **Gaspard Blondet**, *Advanced modeling of cross-laminated timber panel behavior*, advisor Arthur Lebée, fellowship of ENS Paris-Saclay and ENPC
- 2021-now **Sabine Boulevard**, *Failure design of reinforced concrete beams subject to shear and torsional loadings in fire conditions*, advisor Karam Sab, industrial collaboration with CSTB
- 2021-now **Zakaria Chafia**, *Multi-scale modelling strategies for predicting the failure behaviour of cementitious materials*, advisor Julien Yvonnet (Université Gustave Eiffel), funded by LabeX MMCD
- 2020-2023 **Goustan Bacquaert**, *Behaviour of geomaterials for the modeling and safety analysis of geotechnical structures*, advisor Djimédo Kondo (Sorbonne Université), CIFRE funding in collaboration with Électricité de France

- 2018-2021 **Leyla Mourad**, *Topology optimization of structural load-bearing capacity through limit analysis*, advisor Karam Sab, joint thesis with University Saint-Joseph, Lebanon
- 2018-2021 **Paul Bouteiller**, *Failure modeling of composites laminates in a layerwise plate model*, advisor Karam Sab, industrial collaboration with Dassault Aviation
- 2017-2021 **Lucille Salha**, *Mesh adaptation and hybridization for efficient stress prediction in a layerwise plate model*, advisor Karam Sab, joint thesis with University Saint-Joseph, Lebanon
- 2017-2020 **Chadi El Boustani**, *Innovative optimization-based numerical methods for modeling the non-linear behavior of steel structures*, advisor Karam Sab, CIFRE funding in collaboration with Strains
- 2015-2018 **Karol Cascavita**, *Hybrid discretization methods for Signorini contact and Bingham flow problems*, advisors Alexandre Ern and Xavier Chateau, funded by LabeX MMCD
- 2015-2018 **Hugues Vincent**, *Development of a yield design model until failure for 3D reinforced concrete structures*, advisor Patrick de Buhan, CIFRE funding in collaboration with Strains

**Main advisor** (80%) for H. Vincent, C. El Boustani, L. Salha, P. Bouteiller, L. Mourad.

**Co-advisor** (50%) for S. Boulevard and Z. Chafia.

**Participation** (20%) for G. Bacquaert and K. Cascavita.

### Postdoctoral fellows

- 2023 **Mohammad Mainroodi**, *Physics-informed neural networks for the analysis of nonlinear structures*, joint supervision with S. Brisard
- 2021 **Jean-Michel Scherer**, *Multiphase-field modeling of anisotropic brittle fracture in additively-manufactured polycrystals*, joint supervision with Stella Brach (LMS-X), funded by the *Coup de Pouce* grant from Fédération Francilienne de Mécanique

### Master students

- 2023 **Alice Gribonval**, *Modeling of 3D-printed concrete structures*, master thesis ENPC, joint supervision with XtreeE company
- 2022 **Andrey Latyshev**, *Finite-element implementation of standard and softening plasticity using convex programming*, engineering thesis ENPC, joint supervision with Corrado Maurini (Sorbonne Université)
- 2022 **Maximin Duvillard**, *Robust optimization of structures in presence of uncertainties*, engineering thesis ENPC
- 2021 **Zakaria Chafia**, *Multilayer micromechanical model of failure in a matrix/inclusion composite*, master thesis ENPC
- 2020 **Pimprenelle Parmentier**, *Robust optimization for handling uncertainties in structural analysis*, master thesis ENPC, joint supervision with Vincent Leclère (CERMICS, ENPC)
- 2019 **Antoine Martin**, *Buckling behaviour of CLT panels under concentrated load*, master thesis ENPC, joint supervision with Arthur Lebée (Navier, ENPC)
- 2019 **Eki Agouzal**, *Simulation of yield stress fluid flows with free surfaces*, 6 months internship from ENPC, joint supervision with Xavier Chateau (Navier, ENPC)

2018 **Joël Keumo Tematio**, *Buckling modeling of a cylindrical steel grid using an homogenization approach*, master thesis Ecole Polytechnique, joint supervision with Maged Sidhom (IFPEN)

2018 **Mehdi Assad**, *Implementation of the Bending-Gradient on FEniCS*, research internship of Ecole Polytechnique, joint supervision with Arthur Lebée (Navier, ENPC)

### Visiting students

2023 **Hana Herndon**, Georgia Institute of Technology, *Quantifying the uncertainty in a steel bridge with corrosion-induced damage*

2017 **Thomas Westergaard Jensen**, Technical University of Denmark, *Finite-element limit analysis of bridge structures*

### Invitations

2023 **Workshop** CSMA Juniors  
*Hands-on session: Introduction to FEniCSx*

2022 **Workshop** Homogenization and optimization of polymers, Ecole Polytechnique  
*Conic programming approach for the simulation and optimization of nonlinear membranes*

2020 **Workshop** Design challenges of 3D printing in the construction industry  
*Topology optimization for designing structures with optimal load-bearing capacity*

2020 **Workshop** ENPC-University of Tokyo  
*An overview of computational limit analysis for civil engineering applications*

2019 **Workshop** RAM3 - Recent Advances in Mechanics and Mathematics of Materials  
*An overview of computational limit analysis for civil engineering applications*

2015 **Visit (6 weeks)** to University of Newcastle, Australia, with K. Krabbenhoft and A. Lyamin

**Invited seminars** at CEA, EDF, LMS (Ecole Polytechnique), GeM (Centrale Nantes), University of Luxembourg

### Reviewing activities

I have been reviewing for the following journals (14 papers in 2022): Applied Mathematical Modelling, Composites Part B: Engineering, Composites Structures, Comptes Rendus - Mécanique, Computational Materials Science, Computer Methods in Applied Mechanics and Engineering, Engineering Fracture Mechanics, Engineering Structures, European Journal of Mechanics - A/Solids, International Journal for Numerical Methods in Engineering, International Journal of Computational Methods, International Journal of Fracture, International Journal of Solids and Structures, Journal of the Mechanics and Physics of Solids, Marine Georesources & Geotechnology, Meccanica, Mechanics of Materials.

2022 grant proposal for the *Fonds zur Förderung der wissenschaftlichen Forschung* (Austrian Science Fund)

2018 book proposal for ICE Publishing

## Grants

- 2023 **ANR PRC ANOHONA** *Advanced nonlinear homogenization for structural analysis*, Member
- 2022 **Digital Europe** (7M€) *Digital Twins for Complex Infrastructures and Urban ecosystems*, European consortium, WP leader
- 2021 **Labex MMCD**, PhD thesis funding for Zakaria Chafia, with J. Yvonnet (MSME)  
*Multi-scale modelling strategies for predicting the failure behaviour of cementitious materials*
- 2021 **Coup de Pouce F2M** (40 k€), with S. Brach (LMS) *Multiphase-field modeling of anisotropic brittle fracture in additively-manufactured polycrystals*

### Denied

- 2022 ANR JCJC (PI) OROMIS *Robust optimization for uncertainty quantification in structural design*
- 2020 Nuclear Valley DAS4 *Digitization for Optimization of Nuclear Design and Construction*
- 2017 FEDER Ile de France *Yield design of construction wood assemblies*

## Industrial contracts

**CSTB**, support for Sabine Boulevard PhD thesis

**Turbostream Ltd**, scientific consulting mission

**Électricité de France**, support for Goustan Bacquaert PhD thesis

**Setec tpi**, support for Leyla Mourad PhD thesis

**Dassault Aviation**, support for Paul Bouteiller PhD thesis

**Strains**, support for Chadi El Boustani and Hugues Vincent PhD theses + scientific consulting mission

## Involvement in the scientific community

### PhD thesis committees

#### International

- 2023 **Sindhu Nagaraja**, ETH Zürich  
*Phase-field modeling of brittle fracture: anisotropy and efficient discretization*  
Jury: Corrado Maurini, Jérémy Bleyer, Laura de Lorenzis, Aldo Steinfeld
- 2017 **Morten A. Herfelt**, Technical University of Denmark  
*Numerical limit analysis of precast concrete structures*  
Jury: Henrik Stang, Jérémy Bleyer, Bent Steen Andreasen, Peter Noe Poulsen, Linh Cao Hoang, Jesper Frøbert Jensen

## France

- 2023 **David Siedel**, Mines Paris - PSL  
*A robust numerical approach for the description of brittle fracture and viscoplastic behavior of fuel rods*  
Jury: Riccardo Rossi, Sylvain Drapier, Vanessa Lleras, Djimédo Kondo, Jérémy Bleyer, Jacques Besson, Thomas Helfer, Olivier Fandeur, Samuel Forest, Nicolas Pignet
- 2022 **Salim Chaibi**, ISAE Toulouse  
*Prediction of low-velocity/low-energy impact damages in the latest generation of carbon-epoxy laminated composites*  
Jury: Emmanuelle Abisset, Peter Davies, Rodrigue Desmorat, Zoheir Aboura, Jérémy Bleyer, Carlos G. Dávila, Johann Rannou, Christophe Bouvet.
- 2022 **Paul Bouteiller**, ENPC  
*Simulation of laminate composite failure using stress-based layerwise plate models*  
Jury: Véronique Lazarus, Federica Daghia, Corrado Maurini, Johann Rannou, Christophe Bouvet, Fabrice Congourdeau, Jérémy Bleyer, Karam Sab.
- 2021 **Leyla Mourad**, ENPC-Université Saint-Joseph (Beyrouth)  
*Strength-based topology optimization of structures using limit analysis* Jury: Fabrice Gatuingt, Boris Desmorat, Grégoire Allaire, Jérémy Bleyer, Romain Mesnil, Joanna Nseir, Karam Sab, Wassim Raphael.
- 2021 **Lucille Salha**, ENPC-Université Saint-Joseph (Beyrouth)  
*Mesh adaptation and hybridization for efficient stress prediction in a layerwise plate model*  
Jury: Toni Sayah, Olivier Polit, Steven Marguet, Jérémy Bleyer, Joanna Bodgi, Karam Sab
- 2020 **Chadi El Boustani**, ENPC *Innovative optimization-based numerical methods for modeling the non-linear behavior of steel structures* Jury: Habibou Maitournam, Nicolas Moës, Mohammed Hjiij, Mickaël Abbas, Laurence Davaine, Jérémy Bleyer, Xavier Cespedes, Karam Sab
- 2019 **Mohammad El Hajj Diab**, IFSTTAR *Analysis of structural robustness : characterization of accidental/exceptional events and of their impacts on infrastructures* Jury: Stéphane Grange, Alan O'Connor, Mohammed Hjiij, Jérémy Bleyer, Robby Caspeele, Jean-François Demonceau, Cédric Desprez, André Orcesi
- 2018 **Karol Cascavita**, ENPC  
*Hybrid discretization methods for Signorini contact and Bingham flow problems*  
Jury: Raphaële Herbin, Pierre Saramito, Patrick Hild, Miguel Angel Fernandez Varela, Erik Burman, Jérémy Bleyer, Xavier Chateau, Alexandre Ern.
- 2018 **Hugues Vincent**, ENPC  
*Development of a yield design model for 3D reinforced concrete structures*  
Jury: Aurelio Muttoni, Samir Maghous, Géry de Saxcé, Jérémy Bleyer, Patrick de Buhan.
- 2018 **Mingguan Yang**, ENPC  
*Stability of reinforced concrete walls under fire conditions by a yield design approach*  
Jury: Jean-Marc Franssen, François Buyle-Bodin, Mohammed Hjiij, Jérémy Bleyer, Duc Toan Pham, Patrick de Buhan.

## Participation to councils or committees

**Elected member** of Laboratoire Navier council

**Member** of the Civil Engineering Department council at ENPC

**Member** of a hiring committee for a *Maître de conférences* position at Sorbonne Université/Polytech Sorbonne (2021)

## Organization of scientific events

**Core member** of the MEALOR Summer school<sup>1</sup>

**Core member** of the GdR MePhy *Mécanique et Physique des Systèmes Complexes*<sup>2</sup>

**Co-animator** (with Sébastien Brisard) of a working group on Computational tools in Laboratoire Navier

**Co-animator** of the seminar of the *Architectural Materials and Structures* research team at Laboratoire Navier

**Co-organizer** (with Jack Hale and Garth Wells) of the mini-symposium *Developments in automatic code-generation software for computational mechanics* at WCCM-ECCOMAS 2020, Paris (online)

## Others

### Software development

I am strongly involved in the FEniCS users community. I provide regular help on the users forum and I maintain a set of commented demos called *Numerical tours of Computational Mechanics using FEniCSx* oriented towards solid and structural mechanics applications:

<https://bleyerj.github.io/comet-fenicsx/>

Formerly, using the legacy FEniCS package at: <https://comet-fenics.readthedocs.io/>

I am the developer of the open-source `fenics_optim` package:

Repository: <https://gitlab.enpc.fr/navier-fenics/fenics-optim>

Documentation: <https://fenics-optim.readthedocs.io>

I am also involved in the development of the `MFrontGenericInterfaceSupport` open-source project lead by Thomas Helfer (CEA):

<https://thelfer.github.io/mgis/web/index.html>

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<sup>1</sup><https://mealor2.sciencesconf.org/>

<sup>2</sup><https://blog.espci.fr/mephy/>

## Outreach

- **Interview** *La construction, un chantier d'avenir pour la mécanique*, 25 mai 2022. CNRS le Journal, Mécanique : dans l'atelier du futur
- **Article revue Transitions**: Bleyer J., Arquier M., Fliscounakis A., Développement d'outils de calculs innovants dans l'ingénierie de génie civil. *Transitions. Les nouvelles Annales des Ponts et Chaussées*, 2022, Bâtiments et construction en transition, 2, pp.54-59
- **EELISA Innovation Talks/Matinal des Ponts: Digital Twins**, March 28<sup>th</sup> 2023

## Teaching activities

### at École des Ponts ParisTech

#### Professor

- since 2020 : (9h/y) *Damage Mechanics* (M2 Mécanique des Solides : Matériaux et Structures, Sorbonne Université/Ecole des Ponts ParisTech), with Djimédo Kondo then Kim Pham
- since 2017 : (30h/y) *Éléments finis pour le Génie civil* (3rd year engineering, Civil Engineering department)

#### Teaching assistant

- 2014–2015 and 2017–2019 : *Solid Mechanics* supervised by L. Dormieux, 1<sup>st</sup> year engineering degree at ENPC, 85h/year.
- 2011–2015 and 2017–2019 : *Plasticity and Yield design* supervised by P. de Buhan, 2<sup>nd</sup> year engineering degree at ENPC, Civil Engineering Department, 40h/year.
- 2012–2015 : *Homogenization in yield design* supervised by P. de Buhan, master 2 level, ENPC, 20h/year.
- 2012, 2014, 2015 : *Refresher course in Solid Mechanics*, supervised by P. de Buhan, 2<sup>nd</sup> year engineering degree at ENPC, Civil Engineering Department, 20h/year.
- 2011 : *Mechanics of materials and structures at finite strains* supervised by P. de Buhan, master 2 level, ENPC, 20h/year.

### at École Polytechnique

#### Professeur chargé de cours d'exercice incomplet

- since 2020 : MEC430, *Mécanique des milieux déformables*, 2x20h/y
- since 2020 : MEC431, *Solid Mechanics*, 2x20h/y

#### Mentor

2018-2020 : *Modal de Génie Civil* (experimental projects), Mechanical Engineering, Ecole Polytechnique



## **Others**

EPFL, 2016, Teaching assistant, (30h/y) *Continuum Mechanics*, (Bachelor 3rd semester)