

Maxime Vassaux | Curriculum Vitae

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Position

Institut de Physique de Rennes, Université de Rennes

Chargé de Recherche CNRS

Multiscale modelling and simulation of amorphous materials properties.

Rennes, France

Oct. 2022 – Present

Institut de Physique de Rennes, Université de Rennes

Post-doctoral Fellow Fondation ARC for Cancer Research

Multiscale modelling and simulation of bone tissue self-assembly and emergence of mechanical properties.

Rennes, France

Mar. 2021 – Oct 2022

University College London, Department of Chemistry

Post-doctoral Research Associate at the Centre for Computational Science (CCS)

Multiscale modelling and simulation of graphene-based polymer nanocomposites.

London, UK

Jan. 2017 – Mar. 2021

Aix-Marseille Université, Department of Sports Sciences

Post-doctoral Researcher at the Group in Osteoarticular Biomechanics (GIBOc)

Mechanical modelling and simulation of single Mesenchymal Stem Cells adhesion and migration.

Marseille, France

Oct. 2015 – Dec. 2016

École Normale Supérieure, Department of Civil Engineering

Post-doctoral Researcher at the Laboratoire de Mécanique et Technologie (LMT)

Particular modelling for quasi-brittle materials: application to masonry.

Cachan, France

Apr. 2015 – Jun. 2015

Education

University College London

Post-graduate, Data Intensive Sciences

Statistical Analysis of Data and Machine Learning with Big Data

London, UK

Sep. 2017 – Jun. 2018

École Normale Supérieure

Ph.D. in Civil Engineering

Multi-scale modelling of quasi-brittle materials mechanical behavior under cyclic loading

Cachan, France

Jan. 2012 – Mar. 2015

Université Pierre et Marie Curie and École Normale Supérieure

M.S. in Civil Engineering, with honors

Materials science, Numerical methods applied to mechanics, Earthquake engineering, Transfer in porous media

Cachan, France

Sep. 2009 – Sep. 2011

Université Pierre et Marie Curie

Licence (B.S. equivalent) in Mechanical Engineering, with honors

Fluid and solid mechanics, Thermodynamics, Heat and mass transfer

Paris, France

Sep. 2006 – Sep. 2009

Research Experience

Post-doctoral research: Fondation ARC fellowship at Institut de Physique de Rennes (research adviser: A. Ghoufi and F. Artzner).....

- Modelling and simulation of all-atom and coarse-grained molecular dynamics of self-assembly of microfibrils collagen type I.
- Modelling the emergence of advanced mechanical properties (strength, toughness, self-healing) in bone tissue based on collagen self-assembly and mineralisation parameters.
- Understanding the impact of osteosarcoma growth and proliferation on bone tissue remodelling at the molecular level of collagen assembly to improve resection margins.

Post-doctoral research: Centre for Computational Sciences at University College London (research adviser: P.V. Coveney).....

- Understanding the role 2d-nanoparticles (clay, graphene and graphene oxide sheets) on the mechanical properties, including fracture, of polymer-based nanocomposites; focus on interface stress transfer.
- Developing a hybrid multiscale computational method to simulate the dynamics of continuous generic engineering structures informed by the simultaneous simulation of the dynamics of the material molecular structure.
- Optimising the execution of multi-physics and multi-scale simulation workflows on high-performance comput-

ing infrastructures.

- Machine learning surrogate modelling (model-order reduction) of time-dependent molecular dynamics simulations using artificial neural networks, Gaussian processes regression and clustering.
- Developing semi-intrusive uncertainty quantification of multiscale simulations. Led a 6-month consultancy for the UK Atomic Energy Agency to establish uncertainty quantification methods for their future exascale multiphysics model of nuclear fusion plasma dynamics.

Post-doctoral research: Interdisciplinary Group in Osteoarticular Biomechanics at Aix-Marseille Université (research adviser: J.-L. Milan).....

- Developing a particle-based viscoelastic computational model of single stem cell adhesion and migration, linking cellular microenvironment to organelles and cytoskeleton mechanics.
- Exploring the role of the cell nucleus as a mechanical sensor of topography during curvature-guided migration and its interaction with cytoskeletal polymer networks.
- Integrating a complex *in silico* cell model in the experimental protocol of biologists (Laurent Pieuchot, IS2M, CNRS) to provide a quantitative analysis of cell mechanics.

**Doctoral research: Laboratory of Mechanics and Technology at ENS-Cachan (research advisers: F. Rague-
neau, A. Millard and B. Richard)**.....

- Predicting the stability of reinforced concrete shear walls found in nuclear power-plants under seismic loading using a hierarchical multiscale computational method.
- Developing a computational model of concrete at the millimetre continuum scale coupling particle-based and lattice approaches.
- Implementing an algorithm to solve implicitly the quasi-static evolution of fracture and contact mechanics, in absence of uniqueness.
- Investigating cracks interaction influence on stiffness recovery of concrete structure at millimetre scale.
- Formulating macroscopic analytical constitutive laws for concrete based on damage mechanics and accounting for stiffness recovery and hysteresis effects.