**Ado Farsi,** Ph.D.

**CONTACTS**

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**SUMMARY**

[[bio]] **FINITE ELEMENT ANALYSIS SKILLS**

**AREAS OF EXPERTISE**

* Static/dynamic stress and failure
* Model validation / verification
* Multibody / contact interactions
* Fracture mechanics
* Thermomechanical analysis
* Plasticity and damage
* Poroelasticity
* Modal analysis
* Fluid mechanics
* Meshing complex geometries

**SOFTWARE**

* ABAQUS
* MATLAB
* ANSYS
* COMSOL
* FEniCS / Firedrake
* Solidity

COMPUTATIONAL MECHANICS SCIENTIST

**/ FEA & MATERIALS ENGINEER**



# EXPERIENCE

**FINITE ELEMENT ANALYSIS** | **MATERIAL CHARACTERISATION**

#### Engineering analysis | Validation of numerical models | Fracture dynamic and failure simulations | Digital image correlation and tracking methods | Static and dynamic testing

* **RESEARCH FELLOW**

**UNIVERSITY COLLEGE LONDON (UCL),** LONDON, UK

JAN 2023 – CURRENT

[[bio]]

* Finite element modelling of stress, deformation, failure, and fluid flow to model the transition from brittle fracture to plastic flow under high temperature and pressure.
* Corresponding organiser for the 17th U.S. National Congress on Computational Mechanics (Albuquerque 2023), hosting the mini symposium titled “*Mixed Discretization Methods in Solid, Fluid and Coupled Simulations*” and delivering a lecture.
* **RESEARCH ASSOCIATE**

**IMPERIAL COLLEGE LONDON,** LONDON, UK

JUL 2017 - CURRENT

* Industrial collaboration with Johnson Matthey (British multinational chemical company):
  + Designed and conducted static/dynamic bending tests, uniaxial compression tests, indentation tests, and ultrasonic tests.
  + Developed and employed coupled dynamic finite element-discrete element simulations to optimise and assess the deformation, strength, and failure/fragmentation of complex-shaped ceramic pellets. A combination of transducer data and digital image correlation and tracking analyses of high-speed videos were used for material characterisation and model validation. Results were published in a leading peer-reviewed journal ([link](https://www.sciencedirect.com/science/article/pii/S0009250919308991)).
  + Developed and employed numerical models to optimise and assess the packing properties and stress distribution of ceramic pellets of complex shapes. Model validation with X-ray scans. Results were published in a leading peer-reviewed journal ([link](https://www.sciencedirect.com/science/article/abs/pii/S0032591020310639)).
  + Developed an innovative digital image correlation method for bending tests for fast and accurate mechanical characterisation of stiff ceramics. Results were published in a high-impact peer-reviewed journal, Nature´s Scientific Reports. The article achieved broad readership, and was awarded as one of the top 100 (out of 24,000) most read articles on the journal in 2017 ([link](https://www.nature.com/articles/srep46190)).
  + Delivered training classes and workshops, writing software and manuals, for 3 industrial researchers (1 Senior Engineer, 1 Senior Scientist and 1 Principal Researcher at Johnson Matthey) for the use of a coupled finite element - discrete element method software that I have developed.
* Industrial collaboration with PETRONAS (flagship Malaysian energy company):
  + Designed and directed experiments on rock samples (uniaxial, triaxial, Brazilian tests, X-ray scans, and thick wall cylinder tests). Estimated mechanical properties (e.g. Young’s moduli, Poisson ratios, tensile strengths, internal cohesion and friction coefficients, porosities).
  + Created coupled dynamic finite element - discrete element simulations of stress, deformation, and failure/crack propagation. Model validation by comparing simulations and experimental results for uniaxial, triaxial, and advance thick wall cylinder tests.
  + Developed software with accessible graphical user interface currently being employed by reservoir engineers at PETRONAS to identify risk of well instabilities and borehole rock failure.
  + Presented progress and emerging technology overview at key special-interest group meetings, which included meetings with the PETRONAS CTO Nasir Darman.
* Industrial collaboration with Transport for London:
  + Developed new constitutive model to simulate failure and fracture propagation in fibre-reinforced concrete materials with a coupled finite element-discrete element method. Validated the model with bending experiments and scaled tunnel physical models. Results were published in a leading peer-reviewed journal ([link](https://link.springer.com/article/10.1007/s40571-019-00305-5)).
* Industrial collaboration with Well Services Group:
  + Created finite element models to simulate the stress, deformation, and failure of excavated rocks. Model validation with numerical models generated from x-ray scans of samples tested in the lab. Results published ([link](https://onepetro.org/ARMAUSRMS/proceedings-abstract/ARMA19/All-ARMA19/ARMA-2019-1951/125080)) and presented at an international conference.
* Personally awarded the Dame Julia Higgins Engineering Postdoc Collaborative Research Fund for 3 projects for finite element computation simulation of:

**EXPERIMENTAL SKILLS**

**TESTING TECHNIQUES**

* Static / dynamic bending tests
* Uniaxial compressions / tensions
* Single / multistage triaxial tests
* Brazilian disc tests
* High-speed camera recordings
* Micro / nano indentations
* Ultrasonic tests
* FSEM / X-ray scans

**ANALYSIS METHODS**

* Digital image correlation / tracking
* Elastic properties estimation (e.g. Young´s modulus and Poisson´s ratio)
* Strength properties estimation (e.g. tensile strength, internal cohesion, and internal friction)
* Fracture properties (e.g. energy release rate for Mode I and II)
* Mechanical parameters optimisation (e.g. statistical methods, machine learning)

**MAIN PUBLICATIONS**

* Farsi, A. et al. (2021). *Packing simulations of complex-shaped rigid particles using FDEM: An application to catalyst pellets*.
* Farsi, A., et al. (2020). *Strength and fragmentation behaviour of complex-shaped catalyst pellets: A numerical and experimental study*.
* Farsi, A., et al (2019). *Simulation of fracture propagation in fibre-reinforced concrete using FEMDEM: An application to tunnel linings*.
* Farsi, A., et al (2017). Full deflection profile calculation and Young's modulus optimisation for engineered high performance materials.

**16+ publications**

**LANGUAGES**

* English (bilingual)
* Italian (native)
* Spanish (intermediate)

**OTHER INTERESTS**

* Music: rock, jazz, acoustic guitar, ukulele, singing.
* Sport and outdoors: weight training, hiking, running, cycling, swimming.
* Travelling, cinema and food.
  + Residual stresses in 3D printed metal structures.
  + Biomechanics of ulceration in diabetic feet to optimise footwear design on a patient-specific basis.
  + Micro particles for non-invasive measurement of pressure in human patients.
* Main developer of Solidity, a coupled finite element–discrete element code to solve dynamic, highly non-linear mechanical problems ([website](http://solidityproject.com/)).
* Corresponding organiser for the 14th (Paris 2021) and 15th (Yokohama 2022) World Congress in Computational Mechanics, hosted the mini symposium titled “*Combined finite-discrete element methods for multi-body dynamics and fracture mechanics*” and delivering a key-note lecture.
* Presented my research in computational mechanics at 14 conferences, and 3 seminars in the UK, the rest of Europe, Asia and America ([full list](https://www.imperial.ac.uk/people/ado.farsi/page/conferences.html)).
* Member of the Royal Society’s RAMP committee (Rapid Assistance in Modelling the COVID Pandemic) that provided the UK government with scientific advice during the COVID-19 pandemic.
* Elected as delegate for representing postdoctoral researchers and fellows for the Earth Science and Engineering Department at Imperial College London and elected as committee member of the Imperial Postdoc and Fellows Enterprise Network. Awarded with the Team Award in recognition of this work which was described as “above and beyond what is expected of them consistently over the course of a year”.
* Supervised 15 post-graduate students (6 Applied Computational Science & Engineering MSc, 8 Geophysics MSc and 1 Petroleum Engineering MSc).
* **LEAD SOFTWARE ENGINEER**

**TANUKI TECHNOLOGIES,** LONDON, UK

NOV 2020 – FEB 2023

* Developed and validated tanuki™/PyFDEM, an innovative commercial tool for addressing complex mechanical problems in a wide range of engineering sectors. tanuki™/PyFDEM employs the finite-discrete element method to model the mechanical behaviour and failure of materials ([website](https://tanuki.ai/)).
* **LEAD CONSULTANT**

**IMPERIAL COLLEGE CONSULTANTS,** LONDON, UK

FEB 2021 - CURRENT

* Scientific and engineering consultant for technology company Cloud Cycle to develop within a time constraint numerical models to assess the mechanical properties of building materials utilising live data from IoT sensors.

# EDUCATION

## **PhD -** COMPUTATIONAL MECHANICS

AUG 2017, **IMPERIAL COLLEGE LONDON,** LONDON, UK

* Awarded an EPSRC Industrial Cooperative Awards in Science & Technology studentship co-funded by UK-based multinational Johnson Matthey.
* Best Student Paper Award at the 7th International Conference on Discrete Element Methods (Dalian, China).
* Conducted tests with universal testing machines and dynamic mechanical analyses.
* Spain flag icon - Country flagsUnited kingdom - Free flags iconsFlag of Italy - WikipediaDeveloped and validated new computational methods to optimise the ceramic catalyst pellets to produce blue hydrogen.

**Thesis title**: *‘Numerical and experimental investigations of particle stress and fracture for complex-shaped pellets’*.

## **MSc -** CIVIL (STRUCTURAL) ENGINEERING

JUL 2013, **POLITECNICO DI MILANO,** MILAN, ITALY

**Thesis title**: *‘Inverse analysis procedures and possible applications in drilling operations´.*

## **BSc -** BUILDING ENGINEERING

JUL 2010, **POLITECNICO DI MILANO,** MILAN, ITALY

**Thesis title**: *‘Comparative analysis of three models of beams on elastic foundations’*.

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