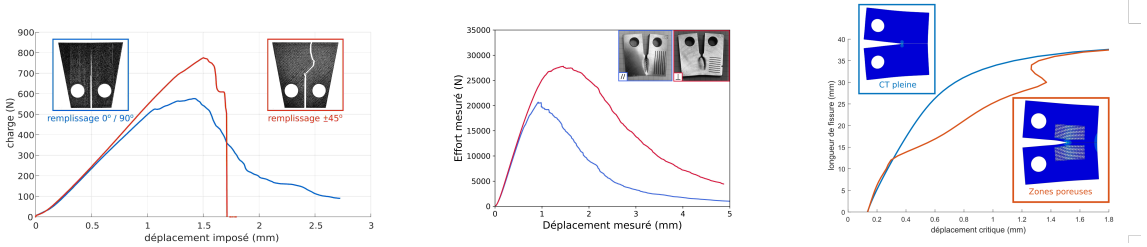
Postdoctoral position in fracture mechanics

Titre : Experimental study of crack propagation in a heterogenous and/or anisotropic material

Responsable/contact : Véronique LAZARUS (veronique.lazarus@ensta-paris.fr)

Host: ENSTA Paris / IP Paris (Department of Mechanics and Energetics, Department of Physics)



(a) Fused Deposit Modeling (postdoc T. Corre, X. Zhai and P. Gazzi Ph. Ds)

(b) Direct Energy Deposition (postdocs T. Corre et D. Roucou)

(c) Influence of a porous zone on the fracture resistance (J. Triclot, Ph. D, INSA Lyon/ENSTA)

Figure 1: Influence of the microstructure on crack propagation

The durability of materials and structures is a major focus of the Institut Polytechnique de Paris. In particular, this position will benefit from the emulation of a larger project that aims to study the propagation of cracks in anisotropic and heterogeneous materials, from both an experimental and a theoretical point of view, with specific safety and environmental concerns, in the continuity of work in progress (see figures). It has received substantial financial support in terms of material and human resources, with the funding of four theses and around 90 months of postdoctoral position covering the period 2022-2028. It associates the departments of Mechanics (IMSIA, LMS) and Physics (PMC) of the Institut Polytechnique de Paris, LMPS - Laboratoire de Mécanique Paris-Saclay and Center for Interdisciplinary Research on Complex Systems of Northeastern university (Boston).

The postdoctoral fellow will take in charge the experimental part of the project that builds on the use of 3D printing facilities, with the aims to (i) optimize printing parameters toward lightness and fracture resistance and to (ii) validate new numerical phase-field approaches [1, 2] for crack propagation in anisotropic and heterogeneous media. Several printing facilities will be explored going from Fused Deposit Modeling of thermoplastic threads [3] to Stereolithography [4], Direct Energy Deposit [5] or Powed Bed Melting of metallic powders. A particular attention will be given on dialog between simulations and experiments with the aim to validate and enrich the models.

Skills: Ph.D in mechanics or physics of solids, structures or materials. Digital Image Correlation and mechanical testing. Good knowledge in continuum mechanics and if possible, in fracture mechanics. Good organisation and ability to work with people from different backgrounds.

When? The position may start as soon as possible. The position is for 24 months, with the possibility of a 6-month extension.

Application procedure: Resume including a list of publications, contact details of 2 referees, cover letter to be sent to veronique.lazarus@ensta-paris.fr. Interested candidates are welcome to contact me if they have any questions.

References

[1] Bin Li and Corrado Maurini. Crack kinking in a variational phase-field model of brittle fracture with strongly anisotropic surface energy. *Journal of the Mechanics and Physics of Solids*, 125:502 – 522, 2019.

[2] Hervé Henry. Limitations of the modelling of crack propagating through heterogeneous material using a phase field approach. *Theoretical and Applied Fracture Mechanics*, 104:102384, 2019.

[3] Thomas Corre and Véronique Lazarus. Kinked crack paths in polycarbonate samples printed by fused deposition modelling using criss-cross patterns. *International Journal of Fracture*, 230(1):19–31, July 2021.

[4] J. Triclot, T. Corre, A. Gravouil, and V. Lazarus. Key role of boundary conditions for the 2D modeling of crack propagation in linear elastic compact tension tests. *Engineering Fracture Mechanics*, 277:109012, 2023.

[5] David Roucou, Thomas Corre, Gilles Rolland, and Véronique Lazarus. Effect of the deposition direction on fracture propagation in a duplex stainless steel manufactured by directed energy deposition. *Materials Science and Engineering: A*, 878:145176, 2023.