

Fracture of fibrous materials

Research M1 or M2 internship, 2024.

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Hosting team ELAN Team (INRIA & LJK, Université Grenoble Alpes), <https://team.inria.fr/elan/>

Practical details: Research internship (M1 or M2) starting in 2024.

Context Structured materials play a pivotal role in a multitude of applications across various industries, including automotive, aerospace, healthcare, and architecture. Understanding the mechanical response and properties of such materials is essential for optimizing their performance and advancing the state-of-the-art in material design and engineering.

Among structured materials we find textiles, which are made up of interlaced elastic fibers called yarns, with a rich range of physical properties. The interplay between elasticity and the frictional contact between interacting fibers has a profound impact on their behavior and performance.

For a long time now, there has been a dedicated engineering community focused in the study of textiles for industrial applications [2]. More recently, researchers in physics, mechanics and computer graphics [1, 3] have gained interest in developing numerical approaches and experimental protocols to model the mechanical response of this systems at different scales and understand the intricate phenomenology observed.

Objective This project aims at using our teams numerical and experimental tools to understand the interplay between fracture and friction as dissipation mechanism of energy in textiles. Hence, this internship has as objective to establish (numerical and/or experimental) protocols to characterize the relation between the macroscopic response of textiles and the structure dynamics and the elastic and frictional properties of yarns.

Skills required We are looking for a motivated candidate with a taste for numerical simulations and/or experiments. We encourage to apply students with a physics background as well as students with interest in computer sciences. Knowledge of at least one programming language is necessary.

How to apply Applications must be sent to victor.romero-gramegna@inria.fr. Please include your CV, resume of courses and grades in your L3 and M1 (M2 if available), a motivation letter explaining your scientific interests, as well as at least two reference contacts (Current professors, previous internship supervisors, etc).

Contract conditions and benefits The successful candidate will be compensate accordingly to Inria's salary grid and be hosted at the ELAN team at Inria's University Grenoble-Alpes center. The team will provide all the necessary conditions to conduct this research. The ELAN team belongs to Inria's University Grenoble-Alpes center and Jean Kuntzmann lab. Inria is a leading edge public institution, with a high quality working conditions and a vibrant and innovative environment.

References

- [1] Samuel Poincloux, Mokhtar Adda-Bedia, and Frédéric Lechenault. Crackling Dynamics in the Mechanical Response of Knitted Fabrics. *Physical Review Letters*, 121(5):058002, July 2018.
- [2] P. Schwartz. *Structure and Mechanics of Textile Fibre Assemblies*. Woodhead Publishing Series in Textiles. Woodhead Publishing, 2008.
- [3] Georg Sperl, Rahul Narain, and Chris Wojtan. Mechanics-aware deformation of yarn pattern geometry. *ACM Transactions on Graphics (TOG)*, 40(4), 2021.

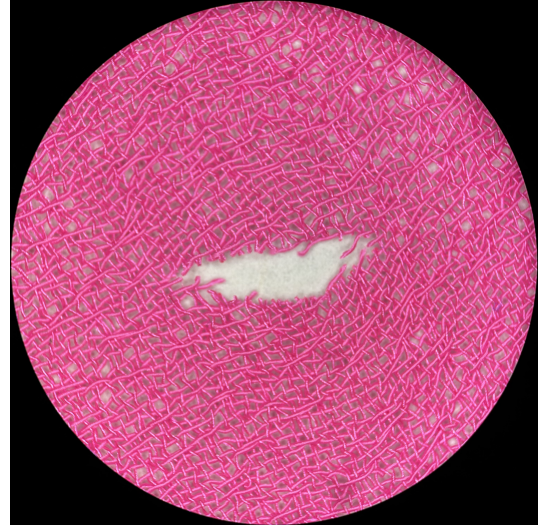


Figure 1: Microscopic view of a fracture in a textile structured material.

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