Identification and modelling of fibre aggregates

Postdoctoral Researcher, Starting Fall 2026

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Hosting Laboratory: ELAN team (Inria and LJK, Grenoble)

Practical details: Post-doctoral position (1 year renewable - max duration of 3 years), salary as defined in Inria scales.

Context: Under some specific stress conditions, random fibrous assemblies may spontaneously yield aggregates of finite size. In nature and industry, examples span from amyloid fibres and spherical packings of marino algae to dust bunnies, hair wisps and glass fibre flakes. In addition to the spontaneous emerging of a number of 'clumps' or 'packets', each one of this clumps exhibits some strong resistance against stretching or shearing, which can be viewed as the emerging of some cohesive behaviour at the macroscopic scale, although no cohesive contact is involved at the micro scale. This outstanding property is leveraged by birds for making nests, and starts being investigated by scientists and architects for building lightweight self-supporting structures at large scales. Besides the scarce physical studies and little understanding of all these complex phenomena, there are still very few attempts to reproduce them with simulation so far.

Objectives: In this project our goal is to explore, understand and model the clumping behaviour that seems to spontaneously emerge in random assemblies of naturally curved fibres interacting solely through contact and friction. To that aim we shall leverage lab experiments and numerical tools (built in our team) to explore different scenarios, in 2D and in 3D, where clumping can be identified and characterised. In a second step, relying on these findings, a theoretical model for clumping will be investigated.

Required Skills: Candidates must hold a PhD in any field among physics / mechanical engineering / applied mathematics / computer science, and have a proven research track record, demonstrated by publications in peer-reviewed journals in one or more of the above areas. A good background in (theoretical or experimental) physics and solid mechanics is expected. Additional skills in dynamical systems, numerical analysis, optimisation, and/or algorithmics and programmation (Python, Mathematica, or C/C++) are a plus. Curiosity and taste for understanding nonlinear physical problems using combined theoretical, experimental and numerical tools are appreciated. The candidate will work in collaboration with other members of the team with complementary expertise.

How to apply Candidates should apply **before July 31, 2026** by sending an e-mail to Florence.Descoubes@inria.fr. Applications will be examined progressively as they are received. The application should contain:

- a cover letter outlining the motivation of the applicant
- a copy of the PhD diploma, together with reviewing and defense reports (if applicable)
- a detailed CV of the applicant, including the publication list, scientific and computing skills, and interests

- one or several reference letters provided (at least) by the PhD advisor(s), possibly also by an academic or industrial partner, or a scientific personality
- any other document that the applicant would like to bring attention to in her/his application.

Keywords: Fibre aggregation, thin elastic rods, dry frictional contact, nonlinear mechanics, physical modelling, numerical simulation, homogenisation.