

Postdoctoral Position (1-year, renewable twice) in
« Geometrical Image Analysis and Modeling of Granular Media »
at the Ecole Nationale Supérieure des Mines de Saint-Etienne, France

The École Nationale Supérieure des Mines de Saint-Étienne (Mines Saint-Etienne), a school of the Institut Mines Télécom (IMT), under the supervision of the Ministry of the Economy and Finance, is responsible for training, research and innovation, transfer to industry and scientific, technical and industrial culture. Mines Saint-Etienne represents: 2,400 student-engineers and researchers in training, 400 staff, a consolidated budget of 46 M€, 3 sites on the Saint-Etienne campus (Loire) of approximately 26,000 m², a Georges Charpak Provence campus in Gardanne (Bouches-du-Rhône) of approximately 20,000 m², 6 research units, 5 training and research centers, and a center for scientific, technical and industrial culture (La Rotonde) Mines Saint-Etienne has development projects in Lyon, notably on the Digital Campus of the Auvergne-Rhône-Alpes region, and numerous international collaborations.

The Georges Friedel Laboratory (LGF) is a CNRS Joint Research Unit (UMR 5307) and belongs to the Institute of Engineering and Systems Sciences (INSIS). Located at the École Nationale Supérieure des Mines de Saint-Étienne and supported by two supervisory bodies (Mines Saint-Étienne and CNRS), the laboratory brings together all the research potential of Mines Saint-Étienne in the fields of materials, mechanics and process engineering.

The Center "Sciences des Processus Industriels et Naturels" (SPIN) is a research, teaching and technology transfer center recognized for its expertise in Process Engineering applied to divided solids (grains, particles, powders, soils, ores). As part of the Georges Friedel Laboratory (UMR CNRS 5307), it uses its scientific skills and state-of-the-art equipment to support innovation in industrial companies faced with the energy transition and the need to invent new high-performance processes and materials. The SPIN center is structured into three departments and six research themes: powder technology, geometry and physical chemistry of granular media, complex hydro-systems and geo-processes, industrial crystallization and application of gas hydrates, reactivity and transformation of solids as well as electrical properties of solids in interaction with a gas and instrumentation.

The successful candidate will be integrated into the Team "Processes in Divided and Multiphase Media" (PMDM) of the LGF laboratory and the SPIN center, whose scientific objective is to better understand and model the multiscale dynamics of divided media (suspensions, emulsions, porous media, etc.). The research missions associated with this position are at the heart of PMDM's research activities on the aspects of image analysis and geometric characterization of divided media.

The theme that we wish to support and strengthen is the "Geometrical Image Analysis and Modeling of Granular Media", especially for the study of divided media (suspensions, emulsions, porous media, ...); it is part of the broader field of mathematics applied to Process Engineering. For the last ten years, the PMDM team has seized the opportunity of numerical simulation to meet the growing industrial needs to control granular processes as well as classical processes. The challenge we are tackling is to develop original models that allow the characterization of the geometry of granular media (crystals, drops, bubbles, particles, pores...) by image processing and analysis in order to simulate in real time industrial size systems (Digital Design). The development of digital twins will help companies to take full advantage of the digital transition to develop high performance processes and materials and thus enter the industry of the future.

To contribute to the achievement of this very ambitious objective, Mines Saint-Etienne is recruiting a 1-year post-doc (renewable twice) in "Geometrical Image Analysis and Modeling of Granular Media".

1. Profile of the candidate

The person recruited will support and reinforce the "Modeling and Geometric Analysis of Images of Granular Media" theme. The candidate should have a PhD, typically in applied mathematics, more specifically in image analysis and/or stochastic geometry (sections CNU 61, 26 - CNRS 41). Post-doctoral experience, particularly in international research, will be appreciated. The candidate must demonstrate scientific competence in one or both of the following areas:

- Image analysis in a broad sense (processing, analysis, modeling)

- Stochastic geometry

Mastery of one or more programming languages (python, matlab, C/C++) is also required. Skills in statistical learning (machine learning, deep learning, ...) will be highly appreciated.

2. Missions

- **Research** (about 70% of the working time): In the framework of the "Geometrical Image Analysis and Modeling of Granular Media" theme, the recruited candidate will participate in various research projects aiming at the implementation of advanced mathematical models and tools for the analysis of images and patterns, and their applications, especially for granular, divided and multiphase media (crystals, drops, bubbles, particles, pores...). For more information: <https://www.mines-stetienne.fr/spin/areas-of-expertise/image-analysis/>

The following missions will be entrusted to the candidate:

- Conduct research activities at the intersection between Process Engineering and image analysis of granular media, in coherence with the objectives of the PMDM team, the SPIN center, the LGF laboratory and Mines Saint-Etienne in general.
 - (Co)Supervise theses and research projects, valorize its results (publications, patents...)
 - Participate in the setting up of collaborative projects, with academic or industrial partners, nationally or internationally
 - Participate in the search for funding from private partners or public organizations
- **Teaching** (approximately 30% of working time): the candidate recruited will be in charge of teaching activities for the different audiences at Mines Saint-Etienne (engineering students and/or employees, master's degree, specialized master's degree, continuing education, doctoral training). Like all teachers in the institution, he/she will be required to give face-to-face courses, supervise projects and internships, contribute to the international mobility of students, and to the dissemination of scientific culture. He/she must be able to teach in English and to participate in the development of innovative teaching methods, particularly through the use of digital technology.

In particular, the incumbent will be responsible for participating in teaching in the following areas related to his/her profile: Image processing, Signal processing, Pattern recognition, Computer science, Big Data, Artificial Intelligence, ... (ICM curriculum, Master MISPA, MeA, GP2EI).

These missions will be carried out on the Saint-Etienne Campus (42) of Mines Saint-Etienne.

3. Evaluation criteria

- Ability to strengthen the research theme "Geometrical Image Analysis and Modeling of Granular Media",
- Teaching experience in the above areas at the graduate level,
- Ability to integrate into the team, center and research laboratory project,
- Scientific production: quality and number of publications in A-rank journals as defined by the HCERES,
- International experience,
- Scientific competences described in section 1.

4. Recruitment conditions

- 1-year fixed-term contract under public law, renewable twice,
 - Full time,
 - Remuneration according to the rules defined by the Institut Mines Télécom's management framework.
- Desired start date: 2nd quarter 2022

5. Application procedures

Applications (covering letter, detailed curriculum vitae and any other element deemed useful for the examination of the application) must be submitted by **31 January 2022 at the latest** on the RECRUTEE platform

<https://institutminestelecom.recruitee.com/o/post-doc-en-modelisation-et-analyse-geometrique-dimages-cdd-de-12-mois-renouvelable-2-fois>

6. For more information

For further information on the position, please contact:

- Jean-Michel HERRI, Head of the SPIN Center (herri@emse.fr, +33 (0)4 77 42 02 92 - <https://www.mines-stetienne.fr/recherche/5-centres-de-formation-et-de-recherche/sciences-des-processus-industriels-et-naturels/>)
- Johan DEBAYLE, Head of the PMDM Team (debayle@emse.fr, +33 (0)4 77 42 02 19 - <https://www.mines-stetienne.fr/lgf/equipes/>)

For any administrative information, please contact:

- Amandine HIRONDEAU (hirondeau@emse.fr, + 33 (0)4 77 42 01 03)