



SPIN Centre for Chemical Engineering
Application for the post of Assistant Professor (*Maître Assistant*) in Numerical simulation of multiphase processes

The École Nationale Supérieure des Mines de Saint-Etienne (EMSE), École de l'Institut Mines Télécom, under the supervision of the Ministry of the Economy, Industry and Digital Technology, is assigned missions of education, research and innovation, transfer to industry and scientific, technical and industrial culture.

The EMSE consists of 1,800 engineering and research students, 420 staff members, a consolidated budget of €50M, three sites on the Saint-Etienne campus (Loire Department), a campus in Gardanne (Bouches-du-Rhône Department), five educational training and research centres, seven research laboratories, a scientific, technical and industrial cultural centre (La Rotonde) and development projects in France and abroad.

The SPIN Centre for Chemical Engineering is a research, teaching and technological transfer center recognized for its expertise in Process Engineering applied to divided solids (grains, particles, powders, soils, ores) at the service of innovation for industrial companies facing the digital and environmental transition. The SPIN center is made up of three departments. The basic characterization tools are grouped on instrument platforms (characterization of the solid, characterization of the liquid). Technological developments are carried out on two platforms, a first dedicated to sensors and instrumentation and a second dedicated to powder technologies (generation and transformation of powders). A third digital platform, to which the position will be assigned, concerns the development of digital twins.

The department "Processes for the Environment and Geo-Resources" (PEG) to which the post will be assigned is developing training, research and transfer to industry in process engineering and geoprocesses, around a thematic central of mineral chemistry (hydrometallurgy, speciation, precipitation, crystallization), implementing multiphase and multiphysical models to change the spatial scale, from nanometer to kilometer. The department thus brings together a multidisciplinary community of ten researchers from process engineering and crystallization on the one hand, and geosciences on the other. The department is attached to two CNRS units, including the Georges Friedel laboratory (UMR CNRS 5307) for the topic of Process Engineering in its industrial dimension.

The theme to be reinforced is digital simulation. We build original models from experimental field studies or in instrumented reactors and pilots developed and built by our engineering team.

The challenge for our team is to couple these multiphase models using simulators by integrating thermochemistry, transfers, crystallization / dissolution kinetics and fluid mechanics to simulate real size systems (from liter to a few tens of cubic meters, from a centimeter to a few kilometers). The position is part of a broader dynamic bringing together some of the staff of the SPIN center for the development of digital twins.

1) Candidate profile and assessment criteria

The candidate should hold a doctorate where he acquired an experience in chemical engineering and numerical simulation (for instants CNU 60, 61 ou 62). Significant experience of teaching in the aforementioned fields (teaching instructor, contracted teacher and/or ATER status (temporary teaching and research assistant status)) at under-graduate or post-graduate cycle levels will be appreciated.

The successful candidate will have experience in at least one of the following research them's:

- process engineering/chemical engineering, in particular applied to dissolution - crystallization - reaction
- fluid mechanics, in particular multiphase systems,
- population balances,
- multiscale modeling and reduction of models,
- artificial intelligence (machine learning),
- high performance computing,
- data processing / integration of data for optimization.

The main evaluation criteria of the candidate will be as follows (non-exhaustive list):

- significant experience in teaching at the second or third cycle level in the aforementioned fields and in the development and implementation of new teaching methods,
- scientific production: number, quality and impact of publications appraised by peers and referenced in international databases such as Scopus, Web of Science, PubMed, Nature Index, arXiv.org,...
- ability to support a 'Habilitation à Diriger des Recherches' in the 5 to 7 years following his recruitment,
- capacity for integration into the project of the platform, the center and the research laboratory,
- English proficiency,
- taking into account the international development projects of the School, significant international experience will be highly appreciated. Otherwise, mobility in a foreign partner establishment must be considered within three years of recruitment.

Furthermore, the jury will assess the candidate's potential to:

- conduct partnership research: direct industrial partnerships, collaborative research, support for start-ups, etc.,
- develop and lead full international partnerships (training and research).

2) Missions

Teaching

The teaching mission consists of providing lessons, tutorials and practical work as well as supervision of projects and internships, in all the courses of Mines Saint-Etienne, including the Ingénieur Civil des Mins (ICM). The courses will also concern research Masters, doctoral training, continuing education and under salaried status, Specialized Masters.

The candidate should be able to cover a fairly wide spectrum among existing or future lessons in the field of chemical and / or environmental engineering, including for example transfers, fluid mechanics (multiphase flows, rheology of suspensions, turbulence , hydrogeology, ...), flowsheet simulation, unit operations.

The recruited person will be actively involved in the teaching teams in charge of the training courses mentioned above. As such, the design of new activities and the development of innovative pedagogies, in particular thanks to digital functionalities, are integral parts of the teaching mission.

The candidate must be able to deliver his lessons and possibly MOOCs in English.

The design, supervision and facilitation activities are taken into account in the minimum annual hourly volume to be provided.

Research

The candidate will join the SPIN center (PEG department) of Mines Saint-Etienne and the Georges Friedel Laboratory (Processes in Dispersed and Multiphase systems- PMDM team) and will participate in the development of the digital twin platform. It will strengthen skills in numerical process modeling in multiphase environments until the construction of process simulators on a real scale (Technology Readiness Level from 4 to 7). He will see to developing skills complementary to the other specialists of the platform, in particular on the aspects which make it possible to address the specific themes of the PEG department:

- treatment and recovery of solid mineral matter,
- recycling and recyclability (water, soil, mineral matter, gas),
- transfers for risk prevention and preservation and restoration of natural and urban areas,
- transport and storage of energy.

Even if its main activity will focus on digital modeling, the future recruited will also participate in the development of instrumented experimental devices, in particular in the research and implementation of measurement instruments necessary for monitoring and obtaining data for model validation.

The missions entrusted to it are to:

- conduct its research in line with the objectives of the PEG department, the SPIN center, the LGF laboratory and Mines Saint-Etienne in general.
- co-supervising theses and research projects, promoting their results (publications, patents, etc.)
- participate in setting up collaborative projects, with academic and / or industrial, national and / or international partners
- participate in the search for funding from industrials and public (ANR, ADEME, Horizon Europe, etc.) and private organizations
- prepare the defense of the 'Habilitation à Diriger des Recherches' in the 5 to 7 years following his recruitment.

These missions will be carried out on the Saint-Etienne Campus (42) of the EMSE, in the SPIN center, within the Georges Friedel UMR CNRS 5307 Laboratory.

3) *Candidate assessment criteria:*

The main candidate assessment criteria are as follows (non-exhaustive list):

- Significant teaching experience (development of digital courses, reference works...) in the previously mentioned fields, at under-graduate or post-graduate level, will be appreciated, along with development of new teaching methods.
- Capacity to reinforce the research theme in numerical simulation in multiphase flows.
- Capacity to successfully integrate the team project, the centre and the research laboratory
- Scientific production: number, quality and impact of peer-reviewed original research papers, book chapters or conference proceedings indexed in international electronic databases such as, e.g.: Scopus, Web of Science, PubMed, Nature Index, arXiv.org ...
- Partnership-based research: direct industrial partnerships, collaborative research, support to start-ups ...
- International partnerships

- Good command of the English language, significant international experience
- Other skills or aptitudes : aptitude for team work, constructing projects, English
- Capacity to obtain the Accreditation to Supervise Research qualification (Habilitation à Diriger des Recherches) in the five to seven years following the candidate's recruitment

4) Recruitment Conditions

By application of the specific status of teaching staff of the Mines Telecom institute (modified decree n° 2007-468 of the 28th March 2007), candidates should hold a doctorate diploma or a similar recognized qualification level, equivalent to the required national diplomas.

In addition, candidates should have European Union citizen status as of the day of the application submission (law 83-634 of the 13th July 1983 referring to the rights and obligations of public employees; Art. 5 and 5 bis).

Required date for taking up the position: 1st October 2020

5) Application procedures

The application file should include:

- An application cover letter
- A curriculum vitae outlining teaching activities, research work and where appropriate, relations with economic and industrial sectors (maximum 10 pages)
- Recommendation letters, at the discretion of the candidate,
- A copy of the Doctorate diploma (or PhD),
- A copy of an identity document

These documents should be addressed for the attention of the Director of the École Nationale Supérieure des Mines de Saint-Étienne, at the latest by the 30 April 2020, date as per postmark, and sent to:

École nationale supérieure des Mines de Saint-Étienne
 For the attention of Madame Elodie EXBRAYAT
 Department of Personnel and Human Resources
 158, Cours Fauriel
 42023 Saint-Étienne cedex 2
 France

Candidates selected for an interview will be informed rapidly. Part of the interview will be held in English. Cover letters, CVs and application files written in English will be accepted, but applicants will have to demonstrate in their application file their ability to efficiently communicate in French with students, fellow faculty members and the school administration. For those invited to be interviewed, the same will be expected in oral form and tested by the selection committee.

6) Further information

For further information concerning the post, contact:

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