PERMANENT RESEARCH POSITION OPEN (M/F)

EXPERIENCED "CHARGE DE RECHERCHE" OR PROFESSOR OPEN

in Computational Mechanics of Materials and Structures

Institution : MINES ParisTech (Ecole Nationale Supérieure des Mines de Paris)
Research Center : Centre des Matériaux

In the frame of the development of research and teaching activities in the area of Mechanics of materials and structures, MINES ParisTech, member of PSL Research University, is opening a permanent position of Experienced Researcher or Professor in Computational Mechanics of Materials and Structures.

This position is targeted to an experienced researcher (f/m) willing to develop multidisciplinary research combining fundamental and applied sciences in the area of computational mechanics of materials, with a focus on plasticity, damage, reliability of materials and structures.

1. RESEARCH AT MINES ParisTech

In line with its training activity, MINES ParisTech develops a research activity that covers a wide range of scientific disciplines. The eighteen research centers are organized in five departments: Earth and Environmental Sciences, Energy and Processes, Mechanics and Materials, Mathematics and Systems, and finally, Economics, Management and Society.

MINES ParisTech research aims at both academic excellence and socio-economic impact. This research model is developed in close interaction with the socio-economic world: private or public sector companies, and also institutions and public administrations. MINES ParisTech is the first school in France by its volume of research on contracts, carried by Armines, the Mines ParisTech Foundation or MINES ParisTech itself. This special positioning allows the School expanding its staff and maintain unique experimental and digital platforms highly appreciated by its partners.

This ability of MINES ParisTech and companies to work together on ambitious scientific and industrial issues is recognized nationally and internationally. For example, the CNRS silver medal awarded to Madeleine Akrich, two French Research Agency industrial chairs and the renewal of the Carnot label in 2016. MINES ParisTech is positioned at the 23rd place in the QS World University Rankings by subject and in the top 100, 150 and 300 of the Shanghai engineering thematic rankings.

2. CENTRE DES MATERIAUX

The Materials Centre of Mines ParisTech is located in Evry (35 km south from Paris). It is also a mixed unit research with CNRS (UMR 7633). It has 180 employees including 35 researchers, 45 engineers and technicians, about 100 PhD and post-doctoral students. The research fields deal with microstructure characterization, mechanical testing and numerical simulations in mechanics, metallurgy, physics and chemistry. The research projects are carried out in close cooperation with industrial partners.

The recruited experienced researcher or professor will be assigned to the scientific division SIMS (Simulation of Materials and Structures) at Materials Centre:

http://www.mat.mines-paristech.fr/Recherche/poles-scientifiques/SIMS/

The SIMS division gathers 14 permanent researchers, 5 associate researchers from other universities and 35 master, PhD students, and post-doctoral researchers. The team is dedicated to the modelling and simulation of material behaviour, structural calculations and computational mechanics. The projects are run in close cooperation with other teams of the lab through PhD works including both simulation and experimental parts. The developed computational models and methods are implemented in the Z-set platform (http://www.zset-software.com/) which includes a Finite Element solver, a rich library of nonlinear constitutive models for materials, parallel solvers, etc. The SIMS team is at the forefront of research in theoretical and computational mechanics. Their members belong to various national and international scientific associations (Euromech, IUTAM, ECCOMAS, CSMA, Mecamat etc.).

3. POSITION DESCRIPTION

The candidate is expected to perform fundamental and applied research in the area of Computational Mechanics of Materials with a focus on plasticity, damage, fracture and reliability of materials and structures. He/she should be autonomous and develop and build research projects in collaboration with academic and industrial partners.

Research

The successful candidate is expected to develop his/her own research direction in the area of Computational Mechanics of Materials and Structures and to participate in the supervision of PhD students, post-doctoral researchers and trainees. He/she will be expected:

- To propose new topics and perform research with a high scientific visibility being also attractive for industrial applications;
- Publish in the best scientific journals;
- Apply for projects on the national and international level and build projects in collaboration with industry keeping, at the same time, high scientific standards.

Research in plasticity and fracture of materials and structures still attracts a strong interest from the academic and industrial world due to the increasing industrial demand in mechanical engineering (optimizing industrial components or analysing accidents or crises). These topics are now revisited in the light of the development of Digital Mechanics which consists in producing materials and structures databases and reduced models allowing for fast and even real time computing. Within the framework of data science related industrial development, expertise in mechanics and materials is of the utmost importance to accelerate computation methods and avoid heuristics in lifetime prediction. The expertise of Centre des Matériaux in nonlinear constitutive laws and lifetime assessment models must be developed further on the basis of the most advanced numerical methods, in particular in the presence of defects produced by new additive manufacturing techniques. In that endeavour, multiscale methods have become standard tools.

Structural analysis is based on the development and identification of reliable and robust elastic-viscoplastic laws, of damage laws and lifing models. Complex loading conditions in industrial components (in the field of transportation, energy and material processing) lead to thermomechanical fatigue, creep and uniaxial or multiaxial fracture. Identification of model parameters should rely on the most advanced field measurements in 2D and 3D (displacements, temperature, crystal orientation…) using optimization methods and parametric studies and reduced order models. The considered structural computation problems are provided directly by industrial partners (divisions for production or method development). Centre des Matériaux provides a unique library of constitutive and damage models that must be further developed by integrating more and more knowledge coming from the physics of materials (thermodynamics, physics, chemistry, metallurgy, ageing…) without loss of numerical efficiency. We are dealing with metallic alloys used in the transportation, energy and processing industry: nickel-based superalloys, advanced steels, titanium and aluminium alloys…

Models rely on micromechanical concepts and methods in order to incorporate the microstructural characteristics and the constitutive behaviour of individual phases. Such multiscale approaches resort to analytical formulations or computational homogenization techniques accounting for the severe strain heterogeneities in the material's microstructure. This double competence in structures and microstructures is provided to our industrial partners in order to develop original and efficient solutions. This methodology must be applied within the framework of Digital Mechanics, which is currently developed in the SIMS team, aiming at taking advantage of the huge need for databases in multiscale mechanics of materials, microstructures and structures. Additive manufacturing is another ongoing revolution which requires the involvement of the SIMS division concerning the prediction of lifetime of components produced in that way and the simulation of the process itself.

The research activity will be connected to a Chair in mechanics of materials, like the current Chaire Cristal with Safran.

Teaching

The successful candidate is expected to participate in various teaching activities at MINES ParisTech, in particular, in teaching for "Paris Sciences et Lettres" (PSL) Research University, Cote d'Azur University as well as Post-Master program in the area of his/her expertise. He/she will participate in teaching for Executive Engineering program of MINES ParisTech and students' projects "The job of engineer". He/she will also be involved in tutoring Post-Master students as well as in advising PhD students. He/she will also be encouraged to suggest new courses which would enrich the spectrum of courses offered by MINES ParisTech.

Courses in mechanics of materials and structures are strong assets of the studies of "ingénieurs civils" at Mines ParisTech.

They span over the three years of the studies and range from the core curriculum (Continuum mechanics, Solid mechanics) up to specialized courses (Linear and nonlinear finite elements, etc.). PhD subjects are generally connected to plasticity and fracture of materials and structures with needs for lifing methods (fatigue, creep etc.).

The experienced researcher or professor will contribute to the development of the electronic platform mms2.ensmp.fr capitalizing teaching material in the broad field of mechanics and materials. He/she will develop interactive simulation tools for e-learning dedicated to the engineer students and also to the international community working on computational mechanics. He/she will advise PhD students in cooperation with the other scientific divisions of Centre des Matériaux, Cemef, Centre de Morphologie Mathématique, and also external institutes (ONERA and CEA in particular).

Valorization

Constitutive, damage laws and lifing models are implemented in the Finite Element Suite Zset (http://www.zset-software.com/), developed at Centre des Matériaux in cooperation with ONERA and commercialized by Transvalor for the industry. Demand for such models from industrial partners in transportation, energy and material processing, does not decrease. These developments are very often performed within the framework of PhD or master theses, in cooperation with the MIMEX scientific division.

Candidate qualifications

The candidate must demonstrate solid experience in the field of constitutive and damage modelling at small and large deformations. He/she must master numerical methods for the integration of constitutive laws and for nonlinear finite element analysis. International experience and cooperation will be appreciated. More in detail, the prerequisites are the following:

- PhD in the field of computational mechanics of materials and structures;
- Expertise in plasticity, damage and fracture of materials and structures;
- Demonstrated experience in students' supervision ;
- Interest to develop at Centre des Matériaux high-level research attracting international recognition, in collaboration with Cemef, Centre de Morphologie Mathématique and ONERA;
- Ability to generate a strong activity in publishing and in research;
- Potential in building research projects;
- Demonstrated experience in working in the international context;
- Demonstrated capacity to communicate in English;
- Will to learn French for foreign candidates;
- Habilitation à Diriger des Recherches or equivalent diploma appreciated.

4. APPLICATION FILE

The application should consist of the following documents:

- A cover letter
- A detailed CV
- Copies of official transcripts for all degrees at all institutions attended
- List of publications and of oral communications at scientific conferences
- Three recommendation letters to be sent by the reference person directly to the electronic address below. Optionally, provide contact details of three researchers to be contacted for recommendation.
- Research project in Computational Mechanics of Materials and Structures (5 page limit)

Please send the documents **before April 26th 2018**, to the following address:
recrutement_2018_pole_sims@mat.mines-paristech.fr

Official webpage:

http://www.mines-paristech.fr/Vous-etes/Candidat-a-un-poste/Offres-de-postes/#assistants_recherche