MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET DE LA COHÉSION
DES TERRITOIRES
Liberté
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Job description - Recruitment 2024

Chargé·e de recherche (Normal Class) of Sustainable Development

(Chargé·e de recherche de classe normale du développement durable - CR CN)

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Université Gustave Eiffel

Job title:	Research Fellow in « Decision sciences for the optimization of rail services »
Institution:	**Université Gustave Eiffel -** https://www.univ-gustave-eiffel.fr/en/
Discipline(s):	Computer Science, automatic control
Speciality(es):	Operations Research, Combinatorial Optimization
Host Research Structure:	COSYS Department (“Components and Systems”), ESTAS laboratory
Location:	Université Gustave Eiffel, Campus of Lille-Villeneuve d’Ascq
Contacts:	Nicolas Hautière, director of the COSYS department, Phone: (+0/33) 1 81 66 85 19, Mail: nicolas.hautiere@univ-eiffel.fr
	Mohamed Ghazel, head of ESTAS laboratory, Phone: (+0/33) 3 20 43 83 93, Mail: mohamed.ghazel@univ-eiffel.fr

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1- Background

A major player in European research on cities and territories, transport and civil engineering, Université Gustave Eiffel, created on January, 1st 2020 from the merger of Ifsttar (French Institute of Transport, Planning and Network Science and Technologies) and the Université Paris-Est Marne-la-Vallée, is a scientific, cultural and professional public institution (like all French universities), with an experimental status and a national presence, which make it a unique university in France. It aims to be a major player in research on transport and cities. The research labs of Université Gustave Eiffel conduct both upstream and more finalised research and expertise in a wide variety of disciplines (mathematics and computer science, electronics, materials, chemistry, civil engineering, geosciences, social sciences, psychology, economics, management, innovation sciences, communication, ethics, history, arts, literature etc.) and in fields with a strong societal impact such as transport, infrastructures, natural hazards and cities, aiming to improve the living conditions of our fellow citizens and, more broadly, to promote the sustainable development of our societies.

The COSYS ("Components and Systems") department aims to develop the concepts and tools needed to improve the basic knowledge, methods, technologies and operational systems required for the renewed intelligence of mobility, infrastructure networks and major urban systems. The aim is to improve their efficiency, safety, carbon footprint and impact on the environment and health. The production of knowledge at the frontiers of practice, its transformation into useful products and bodies of doctrine in support of public

policy, and the evaluation of the transformations brought about by innovations in these fields of activity form the DNA of the department. The COSYS department includes 6 laboratories – including ESTAS laboratory – located on 4 university campuses and an emerging research team in Bordeaux.
For further information: https://cosys.univ-gustave-eiffel.fr/

Since its creation, the ESTAS laboratory's research has focused on improving the safety and performance of guided transport systems. It has contributed to the major technological breakthroughs of the last thirty years, such as automatic metros, coded mono-processors, proof of safety software, interoperability of rail signalling systems (ERTMS) and the microscopic approach to traffic management. The development of guided transport, and rail transport in particular, is at the heart of national and European priorities. Faced with the many challenges that lie ahead, such as the deployment of autonomous trains and the digitization of operating systems, to name but a few, the ESTAS laboratory is keen to renew and strengthen its scientific position, as well as continuing to contribute to the university's public policy support mission.
For further information: https://estas.univ-gustave-eiffel.fr/

2- Job Content

The evolution of the rail system linked to the increase in demand in the years to come and the deployment of technological innovations will give rise to new research questions on the process of rail transport services design. This process starts from the mobility demand to setup resources, schedule services, allocate resources to each service and then deal with operational perturbations. Some of the main scientific challenges are : the scaling up of models and algorithms, the consideration of passenger demand in the different stages of the process, the multiplicity of criteria linked to the different players, the stochasticity of the system and the integration of problems that are traditionally treated separately. To overcome these challenges, the person recruited will conduct research on combinatorial problem: she/he will propose models and algorithms based on the state of the art in various fields of decision science, such as Operations Research, Artificial Intelligence, Simulation or Data Science. The research will focus on several topics, including:

- Development of hybrid or decomposition approaches to large-scale combinatorial problems;
- Consideration of the passenger dimension in the design of networks and services, and in their implementation. Account for the dynamic and elastic nature of demand, also in relation with other modes of transport. Demand will also be considered on several scales: local, national and international;
- Optimization of the use of railway infrastructure to meet increasing traffic demand at different timescales and with new network configurations and signaling systems (new track topology and block definition, introduction of moving block signaling, etc.);
- Integration of problems traditionally treated sequentially and optimization according to multiple criteria in the various stages of the service planning process;
- Redesign of rail services to cope with major disruptions due to natural disasters, malicious acts, terrorist attacks, major accidents...

Generally speaking, a person recruited as a Research Fellow is expected to be involved in production, supervision, research promotion and participation in the development of research programmes at different levels (regional, national, European, international). In particular, the candidate will be expected to publish her/his work in international peer-reviewed journals that meet the standards of her/his discipline, but also in journals or books in the more applied fields of the laboratory. It is also expected to communicate the work to peers, but also to the general public. She/he may also be required to contribute to or carry out expertise tasks. He/she will also participate in the collective scientific life of the laboratory, the department and the university.

In addition to his or her research production activity, a Research Fellow is also expected to develop, in the long term, a diversified activity in all or part of the following activities

- Teaching and research training (teaching, supervision of trainees, doctoral and post-doctoral students, participation in juries and bodies or committees related to teaching)
- Research administration and facilitation activities (team facilitation, project coordination, staff management, management of test facilities)
- Valorisation and transfer activities (research and industrial contracts, consultancy and advisory activities, transfer of research results to the socio-economic world, contribution to public policy development, dissemination of scientific culture)

- International activities (participation in European projects, ongoing international collaborations, contributions to the international visibility of the university)
- Scientific outreach (membership of learned societies, editorial boards, scientific committees of institutes, conferences, recruiting committees).

3- Expected profile

The candidate must hold a PhD in Computer sciences, automatic control, or be able to prove an equivalent level, in particular for applicants from abroad (publications, participation in projects, teaching).

In terms of skills and profile, mastery of combinatorial problem solving techniques from Operations Research and Artificial Intelligence is essential and first of all linear programming, problem decomposition methods, graph algorithms, multiobjective optimization and hybrid models (exact and approximate methods, OR and AI ...). Skills in matheuristics, metaheuristics, simulation and data science will be a very valuable complement.

Experience in supervision activities and in collaborative projects at national and international level will be appreciated.

The candidate's application file should highlight his/her ability to develop the activities (listed above) expected of a research Fellow. Scientific publications at the highest level (international peer-reviewed journals and/or international conferences), participation in research projects (national and/or European), an aptitude for teamwork and scientific leadership, interpersonal skills and oral and written communication skills in French and English will be particularly appreciated. Scientific rigour, as well as autonomy and organisational skills, are obviously expected.

The person recruited will be assigned to the ESTAS laboratory, within the "COSYS Department", on the Gustave Eiffel University campus in Lille-Villeneuve d'Ascq (59).

4- Recommendation

The candidate is expected to propose in his/her application a scientific project in line with the activities of the targeted research team and it is therefore strongly recommended to contact the persons indicated.