CentraleSupélec – Paris Saclay University offers the best possible training for you to become a mature top-level researcher on advanced stochastic modelling and optimization applied to reliability and maintenance in early design, giving you excellent career opportunities. You will become part of a leading international research team and have the chance to conduct ground-breaking research.

If you are establishing your career as scientist and you are looking for the best possible foundation for fulfilling your dreams and ambitions, this is your chance. We offer the best possible training for you to become a mature top-level researcher giving you excellent career opportunities both in academia and industry. As part of a recently started MSCA-DN (Marie Skłodowska-Curie Actions, Doctoral Network) project funded by the EU on two-phase flow in turbomachinery entitled "Training42Phase", Department of Industrial Engineering, CentraleSupélec – Paris Saclay University currently has three openings three PhD positions with focus on reliability and maintenance. The other project partners recruiting PhD students are DTU Construct, Denmark (four PhD positions with focus on aero-thermodynamics), Politecnico di Milano, Italy (two PhD positions with focus on aero-thermodynamics), Imperial College of Science Technology and Medicine, UK (two PhD positions with focus on structural mechanics), and Exergy International Srl, Italy (one PhD position with focus on aero-thermodynamics). The project also includes other industrial partners from large international companies and SMEs.

The green transition of energy systems requires the implementation of a number of novel emerging energy conversion technologies based on turbomachinery with two-phase flow. However, the current level of knowledge and understanding of two-phase flow in turbomachinery is at a very low level, urgently calling for the need of education of scientists that can support the development of such technologies. The aim of Training42Phase is to educate the future leading scientists/engineers within turbomachinery with two-phase flow. The project will provide the scientific and technological basis within aero-thermodynamics, structural mechanics, and reliability and maintenance required for the development of the next generation of turbomachinery with two-phase flow. Within this project you will get the chance to break new ground at the absolute forefront of what is possible. You may read more about the Training42Phase project [here].

**Responsibilities and qualifications**
Each of  the three PhD students at CentraleSupélec will focus on one of the following topics:
(i) Reliability modelling and predictive maintenance for two-phase turbomachinery
; (ii) Optimization methods dedicated to maintenance decision-making under uncertainties
; and (iii) Reliability based design optimization of turbo machinery – Use of digital twin and advanced optimization. These projects will be carried out in close cooperation with the other PhD projects within the project, supported by the industrial partners.

If you have a passion for research and a background in reliability, operation research, computer science or applied mathematics, with curiosity for turbomachinery design and thermal sciences, you may be the person we are looking for. You will become part of a leading international research team, and together with colleagues, you will get the opportunity to conduct ground-breaking research within the field of early design reliability and maintenance. The results of your research will contribute to expand the use of

renewable energy sources, reducing carbon dioxide emissions and mitigating climate change.

Responsibilities:
For (i)
- Understand the main failure mechanisms that lead to performance degradation of two-phase turbomachinery considering aero-thermodynamics and structural mechanics;
- Develop quantitative reliability models for two-phase turbomachinery;
- Develop remaining useful life prediction algorithms and predictive maintenance optimization models for two-phase turbomachinery;
- Develop a reliability centered maintenance optimization model for two-phase turbomachinery
- Evaluate the performance of the developed models through use cases compare it with existing methods from literature and validate the models based on literature data and industry input
- 

For (ii)
- Understand and identify all the uncertainty recourses of the maintenance optimization model;
- Develop effective statistical models of deeply uncertain parameters that are able to integrate all available information while facilitate a tractable formulation of the optimization problem;
- Develop efficient solution algorithm for the proposed optimization problem, and validate the models based on literature data and industry input.

For (iii)
- Develop a new reliability-based design optimization (RBDO) method based on digital twins
- Develop an advanced optimization model for RBDO under deep uncertainty;
- Develop efficient solution algorithm for the proposed optimization problem;
- Evaluate the performance of the developed models through use cases compare it with existing methods from literature and validate the models based on literature data and industry input.

For all
- Contribute to the teaching activities at the department, for example by supervising MSc or BSc thesis students.

Qualifications:
You must have a two-year master's degree (120 ECTS points) or a similar degree with an academic level equivalent to a two-year master's degree.
Furthermore, note that the MSCA-DN mobility clause applies; the applicant must not have resided or carried out his/her main activity (work, studies, etc.) in France for more than 12 months in the 36 months immediately before the date of recruitment. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention1 are not taken into account.

**Approval and Enrolment**
The scholarship for the PhD degree is subject to academic approval, and the candidate will

be enrolled in one of the general degree programs at CentraleSupélec. For information about our enrolment requirements and the general planning of the PhD study program, please see: https://www.universite-paris-saclay.fr/recherche/doctorat-et-habilitation-diriger-des-recherches-hdr

CentraleSupélec is a leading technical university globally recognized for the excellence of its research, education, innovation, and scientific advice. We offer a rewarding and challenging job in an international environment. We strive for academic excellence in an environment characterized by collegial respect and academic freedom tempered by responsibility.

**Salary and appointment terms**
The appointment will be based on the collective agreement with CentraleSupélec. The allowance will be agreed upon with the relevant union. The period of employment is 3 years.

You can read more about career paths at CentraleSupélec by following the link below : Le cadre des formations et activités doctorales | Université Paris-Saclay (universite-paris-saclay.fr)

**Further information**
Further information may be obtained from Professors Anne Barros, Yiping Fang and Zhiguo Zeng tel.: +33 785852967,

You can read more about Department of Industrial Engineering at http://www.lgi.centralesupelec.fr

If you are applying from abroad, you may find useful information on working in France and at CentraleSupelec – ParisSaclay University, please see the link below:
Accueil des publics internationaux | Université Paris-Saclay (universite-paris-saclay.fr)
Furthermore, you have Doctoral webinars: a forum for discussion and debate on everyday and emerging issues related to the doctorate, whether everyday or emerging.
webinaire_doctorants_2023.pdf (universite-paris-saclay.fr)


**Application procedure**
Your complete your application on line:
https://candidatures.centralesupelec.fr/campaign/651697ca40d6e000137219cd?lang=en

You may apply prior to obtaining your master's degree but cannot begin before having received it.

Applications received after the deadline will not be considered.

All interested candidates irrespective of age, gender, race, disability, religion or ethnic background are encouraged to apply.

**CentraleSupélec** is a public French institute of research and higher education in engineering sciences and a founding member of Paris-Saclay University. CentraleSupélec is a reference in the field of engineering and systems sciences and a leading engineering Institution in the

area of higher education and research. Paris-Saclay University is ranked 13th in the academic ranking of world universities (and 1st in Mathematics). **The research team R3** (Risk, Reliability and Resilience "http://r3.centralesupelec.fr/") is developing research activities for risk analysis and resilience of complex engineered systems. Since more than ten years, the team is developing models and tools to assess and optimize the resilience of complex systems and critical infrastructures by modeling and optimizing the processes of barrier management, mitigation, crisis management, recovery (http://r3.centralesupelec.fr/index.php/en/publication_list).


**Technology for people**

The CentraleSupélec Research Center's mission is to contribute effectively, through the advancement of knowledge, to the development of innovative responses to major technological and societal challenges. Covering all Engineering and Systems Sciences, it implements multidisciplinary projects, in collaboration with French and international academic partners and in strong interaction with companies in the main economic sectors. CentraleSupélec has 4200 students in three campuses in France, 850 employees and 3 Engineer Schools abroad (China, India, Morocco). We work in collaboration with 176 universities and 140 industry partners.