NTNU
Norwegian University of Science and Technology

Jobbnorge ID: 188994
Deadline: 7/13/2020
Website: http://www.ntnu.no
Scope: Fulltime
Duration: Temporary

The Department of Electric Power Engineering has a vacancy for a

PhD position in power electronics: Diagnostics and prognostics for power electronics converters in large-scale accelerator facilities

This is NTNU

At NTNU, creating knowledge for a better world is the vision that unites our 7 400 employees and 42 000 students.

We are looking for dedicated employees to join us.

You will find more information about working at NTNU and the application process here.

Video: https://www.youtube.com/watch?v=clgKd1SwGLI

About the position

The Department of Electric Power Engineering at NTNU (https://www.ntnu.edu/iel) and CERN the European Organisation for Particle Physics have a vacancy for a full-time 100% position (3 years) as a PhD candidate within the field of power electronics - **Diagnostics and prognostics for power electronics converters in large-scale accelerator facilities**. The PhD student will spend 18 months with the Department of Electric Power Engineering at NTNU, Trondheim and 18 months with CERN in Geneva.

The PhD candidate will work in an internationally joint research project between NTNU and CERN.

During the 18-month employment at NTNU, the prospective candidate will work in the research group Power Electronic Systems and Components (PESC), https://www.ntnu.edu/iel/groups/pesc#/view/about, while during the 18-month employment at CERN, the candidate will be employed at the Electrical Power Converters group (http://te-dep.web.cern.ch/content/electrical-power-converters-group-epc).

The position reports to Head of Department.

Duties of the position

The key technology that supplies electric power to the large-scale particle accelerator facilities at CERN is power electronics converters. Today, there are approximately 5000 converters rated from 1kW to 60MW installed at CERN facilities, which are expected to operate reliably and with the minimum possible number of failures for several decades. The most vulnerable power electronics converter components are the power semiconductor devices, capacitors, cooling systems, as well as, auxiliary circuits used for control and measurement.

CERN, a pioneer in big data and remotely operated equipment, is centrally managing its infrastructure, including power converters, from the CERN Control Center. A dedicated control framework permits the remote control of the converter state (e.g. on, off, cycling etc.), as well as allowing experts to acquire measurements on-demand. A wealth of data is, thus, available to engineers from all these “connected” devices making CERN power converters one of the largest known platforms for developing centralised prognostics and diagnostics. These big data contain useful information that can be utilized either to design converters with enhanced reliability offline based on the post-mortem failure profiles, or to enable online reliability enhancement of the converters.

The PhD student will design, implement and experimentally test software to perform prognostic and diagnostic functionalities that could be integrated within the accelerator ecosystem at CERN. The key tasks to be performed are:

- Develop simulation models of existing power electronic topologies used at CERN.
- Simulate failure mechanisms and prognostics.
- Develop tools in Python that implement these diagnostics and prognostics interfacing the CERN power converter control framework.
- Use acquired data to develop design methodologies for highly reliable power electronics operating under various mission profiles.
- Regularly publish results in scientific journals and conferences, and present to project stakeholders.

Within the project, small-scale prototyping and experimental validation of failure mechanisms in power semiconductor devices will be performed. These will be carried out in the Power Electronics Laboratory at the Department of Electric Power Engineering at NTNU. The laboratory is equipped with advanced high-frequency and high-accuracy measurement instruments (e.g. high-bandwidth oscilloscopes and impendence analysers), high-power and medium-voltage variable electric power sources and electronic loads, as well as, power semiconductor modules testing (e.g. power cycling testers and I-V curve tracer) and building facilities (i.e. die-attaching and bond-wiring equipment).

The PhD student will be a member of the Power Electronics Systems and Components research group (PESC) at NTNU, https://www.ntnu.edu/iel/groups/pesc#/view/about and a member of the Electrical Power Converters group at CERN (http://te-dep.web.cern.ch/content/electrical-power-converters-group-epc). The supervisors of the PhD student will be Associate Professor Dimosthenis Peftitsis, https://www.ntnu.no/ansatte/dimosthp from NTNU, Dr. Konstantinos Papastergiou and Dr. Raul Murillo Garcia from CERN.

Required selection criteria

The objective of the PhD education is to qualify for scientific research of high international standard. The PhD education has a nominal duration of three years of full-time study and includes required coursework or similar academic training comprising a minimum of 30 credits. The most important component of the PhD education is an independent scientific research project carried out under academic supervision, which results in the PhD thesis. The PhD degree is conferred based on these two elements and the doctoral examination, which consists of a trial lecture and a public defense of the scientific thesis.

The candidate should be an Electrical or Electronics Engineer and hold a Master's degree in Power Electronics or similar field (e.g. Smart grids) with a grade of B or better in terms of NTNU's grading scale. Experience and a strong interest in informatics, big data or machine learning is required and should be demonstrated by university assignments, prototypes, work placements etc.

In particular previous work with Python or other object oriented languages would be a plus. Additionally, a record of scientific publications in international journals and conferences are merited.

Furthermore, students should satisfy the CERN requirements for applicants to the Doctoral Programme. A successful application to the CERN Doctoral programme is a condition.

The appointment is to be made in accordance with the regulations in force concerning State Employees and Civil Servants and national guidelines for appointment as PhD, post doctor and research assistant.

NTNU is committed to following evaluation criteria for research quality according to The San Francisco Declaration on Research Assessment - DORA

Other qualifications

Applicants must have very good English language skills, written and spoken. Applicants from non-English speaking countries outside EU/EEA/Switzerland must provide preliminary documentation of English language proficiency, in terms of an approved test. The following tests can be used: TOEFL, IELTS and Cambridge Certificate in Advanced English (CAE) or Cambridge Certificate of Proficiency in English (CPE).

Further assessment of both written and oral English language skills and the ability to communicate fluently will be conducted in the continued selection process and during any interviews for all applicants.

Personal characteristics

In the evaluation of the candidates, emphasis will be placed on education, experience and personal suitability, as well as personal motivation for the position, in terms of the qualification requirements specified above. We look for candidates who show clear signs of independence, original thinking and scientific mindset.

We offer

- exciting and stimulating tasks in a strong international academic environment
- an open and inclusive work environment with dedicated colleagues
- favourable terms in the Norwegian Public Service Pension Fund

Salary and conditions

During the employment period at NTNU, the PhD candidate will be remunerated at gross NOK 479 000 per annum. From the salary, 2% is deducted as a contribution to the Norwegian Public Service Pension Fund.

The employment contract is for three years.

Appointment to a PhD position requires admission to the PhD programme in Electrical Power Engineering. Applicants must be qualified for admission as PhD students at NTNU. See https://www.ntnu.edu/ie/research/phd for information about PhD studies at NTNU.

As a PhD candidate, you will have to successfully complete the PhD academic training programme; the training includes mandatory course work and other obligatory activities. Within the first three months of your employment, you must formally qualify for admission to the PhD programme at the Faculty of Information Technology and Electrical Engineering.

Special employment conditions for this position

The selected candidate is expected to be employed by NTNU in Trondheim for periods equivalent to 1.5 full year and by CERN in Geneva for a period of 1.5 years. More information about benefits and work conditions at CERN can be found here: https://jobs.smartrecruiters.com/CERN/743999673031233-doctoral-student-programme

About the application

Please submit your application electronically via jobbnorge.no. Applications submitted elsewhere will not be considered. Diploma Supplement is required to attach for European Master Diplomas outside Norway. Chinese applicants are required to provide confirmation of Master Diploma from China Credentials Verification (CHSI).

The application must contain:

- A cover letter where the applicant describes his/her personal motivation and how he/she intends to fill the position.
- Curriculum vitae (CV) which includes information about the candidate's prior education, work experience, academic merits and any scientific publications.
- Certified copies of academic diplomas and certificates.
- Applicants from universities outside Norway are kindly requested to send a diploma supplement or a similar document, which describes in detail the study programme and grading system.
- The required documentation of English language proficiency.
- Names and contact information of at least two references.

Incomplete applications will not be taken into consideration.

The engagement is to be made in accordance with the regulations in force concerning State Employees and Civil Servants, and the acts relating to Control of the Export of Strategic Goods, Services and Technology. Candidates who by assessment of the application and attachment are seen to conflict with the criteria in the latter law will be prohibited from recruitment to NTNU.

The Department of Electric Power Engineering works closely with key players in the Norwegian electricity supply sector, which manage critical infrastructure. A comprehensive risk assessment of the candidates' research interests and potential activities related to national threat assessments will therefore also form basis for the final selection of candidates.

In the final assessment of the candidates also strategic considerations at the Department of Electric Power Engineering will be taken into account.

Application deadline: 13.07.2020

General information

A good work environment is characterized by diversity. We encourage qualified candidates to apply, regardless of their gender, functional capacity or cultural background. Under the Freedom of Information Act (Offentleglova), information about the applicant may be made public even if the applicant has requested not to have their name entered on the list of applicants.

The city of Trondheim is a modern European city with a rich cultural scene. Trondheim is the innovation capital of Norway with a population of 200.000. The Norwegian welfare state, including healthcare, schools, kindergartens and overall equality, is probably the best of its kind in the world. Professional subsidized day-care for children is easily available. Furthermore, Trondheim offers great opportunities for education (including international schools) and possibilities to enjoy nature, culture and family life and has low crime rates and clean air quality.

As an employee at NTNU, you must at all times adhere to the changes that the development in the subject entails and the organizational changes that are adopted.

Questions about the position can be directed to Associate Professor Dimosthenis Peftitsis dimosthenis.peftitsis@ntnu.no, or to Head of Department Prof. Ole-Morten Midtgård ole-morten.midtgard@ntnu.no.

Questions related to employment at CERN can be sent to Dr. Konstantinos Papastergiou k.papastergiou@cern.ch

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The Norwegian University of Science and Technology (NTNU) creates knowledge for a better world and solutions that can change everyday life.

Department of Electric Power Engineering

The Department of Electric Power Engineering is one of the seven departments at the Faculty of Information Technology and Electrical Engineering. Our department is Norway's leading in the field, and our vision is to be at the centre of the digital, green shift. We have excellent collaboration with business and industry as well as other universities and research organizations internationally. This gives us outstanding opportunities for interdisciplinary research with high relevance for the society, addressing industrial needs and global challenges.

Additional information

Place of service:

Campus Gløshaugen 7491 Trondheim (Trondheim Municipality)