The Department of Mathematical Sciences has a vacancy for a PhD candidate in computational mathematics.

**Numerical solution and optimization of multiphysics problems in large-scale liquid hydrogen transport**

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=cIgLd1SwGLI](https://www.youtube.com/watch?v=cIgLd1SwGLI)

**About the position**

A new PhD fellowship in computational mathematics is available at the Department of Mathematical Sciences at NTNU.

The workplace will be Trondheim.

You will report to the Head of Department.

The Department of Mathematical Sciences at NTNU is Norway's largest university environment in mathematical sciences with 85 permanent staff members and about 100 doctoral students and postdoctoral fellows. The department conducts research at an international high level within the disciplines of algebra, analysis, didactics of mathematics, differential equations, geometry/topology, numerical analysis, optimization, and statistics. Part of the research is also conducted in close cooperation with other fields of science and technology at NTNU, as well as in cooperation with industry and external research institutions.

This exciting and cross-disciplinary project is concerned with the numerical solution and optimization of challenging multiphysics problems arising in the development of the next-generation, large-scale liquid hydrogen transport infrastructure.

Hydrogen has the potential of becoming a major energy commodity which can enable low- or zero-emission energy use in several of the world's energy sectors, such as power generation, road and rail transport, sea transport and energy and emission-intensive industries. A major challenge in a mass rollout scenario for hydrogen is energy- and cost-efficient storage, transport and distribution from origin to end users. Liquid hydrogen (LH2) transport and storage is a promising option and has the potential to play a major role in global hydrogen trade, but low density of hydrogen and extremely low boiling point pose several challenges when engineering large-scale transport and storage systems. The LH2 Pioneer (LH2P) project led by SINTEF Energy Research will address these challenges by developing a new, ultra-insulated containment concept for large-scale liquid hydrogen ship transport.

Flexible, cost and time-effective studies of LH2 containment technologies are only possible by means of computer simulations. An integral part of the LH2P project is thus to develop high-fidelity computational models for the assessment of physical key characteristics of LH2-containment system including fluid-dynamical properties, heat and mass transfer, and material stress. The resulting models will be combined with state-of-the-art optimization techniques to further explore the improvement potential of the containment concept.

**Duties of the position**

The PhD project offers multiple research directions where one can develop and apply novel state-of-art computational methods, including:

- modern finite element/volume techniques for the numerical solution of multiphysics problems,
- machine learning techniques and reduced order models for extracting coarse-grained representations from high-fidelity models,
- topology and shape optimizations for the optimal design of LH2 containment structures.

- Supported by a strong consortium consisting of multiple industrial and academic partners, this PhD position within the LH2P project will give you a unique opportunity to work in a stimulating interdisciplinary research environment, and to gain first-hand experience in translating modern numerical algorithms to open source simulation software for highly relevant large-scale industrial problems.

**Required selection criteria**

The PhD-position's main objective is to qualify for work in research positions. The qualification requirement is that you have completed a master's degree or second degree (equivalent to 120 credits) with a strong academic background in numerical mathematics, computational engineering, computational physics or equivalent education with a grade of B or better in terms of NTNU's grading scale. If you do not have letter grades from previous studies, you must have an equally good academic foundation. If you are unable to meet these criteria you may be considered only if you can document that you are particularly suitable for education leading to a PhD degree.
Applicants who do not master a Scandinavian language must document a thorough knowledge of English (equivalent to a TOEFL score of 600 or more).

MSc students who expect to complete their master’s degree studies by summer 2021 are also encouraged to apply. Employment will then be postponed until the master’s degree is finished.

Preferred selection criteria
- Basic theoretical knowledge in partial differential equations and their numerical solution
- Experience in programming numerical methods is highly desirable, in particular knowledge and experience with programming languages, preferably in Python, Julia, or C++.
- Experience with open source finite element/finite volume software such as FEniCS, firedrake, deal.ii, mfem, ngsolve, gridap, openFOAM etc. are advantageous but not required.

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.

Personal characteristics
- Highly motivated for pursuing a PhD degree
- Good communication skills
- Dedicated to work both in an interdisciplinary team and independently
- Willingness to learn and to face interesting challenges

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
- employee benefits

The department has a strong focus on a good work environment for both permanent and temporary employees. As part of this effort, we offer both social and scientific activities for our PhD candidates.

Salary and conditions
PhD candidates are remunerated in code 1017, and are normally remunerated at gross from NOK 482 200 per annum before tax, depending on qualifications and seniority. From the salary, 2% is deducted as a contribution to the Norwegian Public Service Pension Fund.

The period of employment is 3 years with no teaching, but the Department may order a 4th year with teaching and other duties for approximately 25% of the entire 4-year period.

Appointment to a PhD position requires that you are admitted to the PhD programme in mathematics within three months of employment, and that you participate in an organized PhD programme during the employment period. Please see http://www.ntnu.edu/ie/research/phd for information about the PhD programme at NTNU.

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. After the appointment you must assume that there may be changes in the area of work.

It is a prerequisite you can be present at and accessible to the institution on a daily basis.

About the application
The application and supporting documentation to be used as the basis for the assessment must be in English.

Publications and other scientific work must follow the application. Please note that applications are only evaluated based on the information available on the application deadline. You should ensure that your application shows clearly how your skills and experience meet the criteria which are set out above.

The application must include
- CV, certificates and diplomas
- Academic works - published or unpublished - that you would like to be considered in the assessment (up to 5 works)
- Name and address of two to three referees

Joint works will be considered. If it is difficult to identify your contribution to joint works, you must attach a brief description of your participation.

In the evaluation of which candidate is best qualified, emphasis will be placed on education, experience and personal suitability.

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

General information
Working at NTNU
A good work environment is characterized by diversity. We encourage qualified candidates to apply, regardless of their gender, functional capacity or cultural background.

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.

In accordance with The Public Information Act (Offentleglova), your name, age, position and municipality may be made public even if you have requested not to have your name entered on the list of applicants.

If you have any questions about the position, please contact Assoc. Prof. André Massing, email: andre.massing@ntnu.no.

Please submit your application electronically via jobbnorge.no with your CV, diplomas and certificates. 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).

If you are invited for interview you must include certified copies of transcripts and reference letters.

Please refer to the application number 2021/22138 when applying.

Application deadline: 26.05.2021.

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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 Mathematical Sciences

We are Norway’s largest university environment in mathematical sciences. The Department has a particular responsibility for all basis education in mathematical sciences for engineering and natural science students at NTNU. We focus on long-term basic research and applied research at a high international level. Our aim is to meet the society’s needs for mathematical and statistical expertise in business and public administration as well as in the research and education sector. The Department of Mathematical Sciences is one of seven departments in the Faculty of Information Technology and Electrical Engineering.

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