PhD: Non-linear Dynamics of Nanomechanical Systems for Atomic Force Microscopy

Faculty / department Mechanical, Maritime and Materials Engineering
Level MSc degree
Maximum employment Maximum of 38 hours per week (1 FTE)
Duration of contract 4 years
Salary scale €2222 to €2840 per month gross

Mechanical, Maritime and Materials Engineering

The 3mE Faculty trains committed engineering students, PhD candidates and post-doctoral researchers in groundbreaking scientific research in the fields of mechanical, maritime and materials engineering. 3mE is the epitome of a dynamic, innovative faculty, with a European scope that contributes demonstrable economic and social benefits.

The Department of Precision and Microsystems Engineering (PME) focuses on developing knowledge and methods for small, innovative, high-precision devices and systems, such as precision equipment and scientific instrumentation for the high-tech industry. Increasing miniaturisation and function density along with improving precision, speed and reliability are the key topics in our work. Our approach is multidisciplinary, fundamental and inspired by industry needs.

The vacant position is part of a joint project between Dynamics of Micro and Nanosystems (DMN) and Micro and Nano Engineering (MNE) research groups. These groups focus on exploiting dynamics of small scale systems to create technologies for improving accuracy and reliability of scientific instrumentation. Our research topics span from measuring and manipulating materials at the micro and nano scale, to the design of reliable MEMS and NEMS devices.

You will be working in an international environment in one of the leading technical universities of Europe, with access to the state-of-the art micro-nano testing facilities and advanced numerical modelling tools. You will be contributing to a challenging topic in a team comprising of mechanical engineers and physicists. The project involves close collaboration with industrial partners and research institutes that focus on the advancement of scanning probe microscopy techniques.

Job description

Following its success in nanoscale imaging, Atomic Force Microscopy (AFM) has been widely used in metrology, nanomechanical studies, and material sciences. A major concern in AFM studies is that, during highly non-linear tip–sample interactions, the tip can wear or break which reduces accuracy and reliability of the measurements. This irreversible deterioration of the tip and the precise estimation of sample properties are concerns as old as AFM itself. As a PhD student you will focus on developing new methodologies in dynamic mode AFM that allow continuous monitoring of the tip and nanomechanical measurement quality, during AFM measurements. Your tasks include:
1. Developing and conducting research on non-linear dynamics of atomic force microscopy.
2. Establishing reduced-order models for cantilever dynamics, and implementing numerical and analytical non-linear dynamics techniques at the nanoscale.

3. Performing experimental research to validate these models, and investigating the rich dynamic phenomena that arise from tip-sample interactions.
4. Developing a non-linear system identification toolbox for multi-parameter estimation in dynamic mode AFM using the intrinsic non-linearities of the AFM.
5. Writing a doctoral dissertation, publishing results in renowned peer-reviewed journals, and presenting research in international conferences.

Requirements

Applicants should have the following qualifications:
• MSc university degree in mechanical engineering, physics or a related area, with a solid background in vibrations, non-linear mechanics, MEMS or NEMS.
• Experience in numerical modelling and analytical/computational tools.
• High motivation for teamwork and good communication skills.
• Experience in atomic force microscopy techniques, experimental dynamics at the microscale, microfabrication, or contact mechanics is an advantage.

Conditions of employment

The TU Delft offers a customisable compensation package, a discount for health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. An International Children's Centre offers childcare and an international primary school. Dual Career Services offers support to accompanying partners. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities.
As a PhD candidate you will be enrolled in the TU Delft Graduate School. The TU Delft Graduate School provides an inspiring research environment; an excellent team of supervisors, academic staff and a mentor; and a Doctoral Education Programme aimed at developing your transferable, discipline-related and research skills. Please visit http://graduateschool.tudelft.nl/ for more information.

Information and application

For more information about this position, please contact Dr. Farbod Alijani, phone: +31 (0)15-2786739, e-mail: f.alijani@tudelft.nl. To apply, please send a letter of motivation, a list of three reference contacts, a complete CV with transcripts and a list of publications (if any) by 10 July 2017 to Celia Moualed, by email to application-3mE@tudelft.nl. The position could start as early as September 2017.

When applying for this position, please refer to vacancy number 3ME17-29.