Advanced guided wave imaging techniques for monitoring of thin-walled structures

Summary

Current efforts in non-destructive evaluation research are focusing on the development of more quantitative inspection methods and exploitation of automation to eliminate time-consuming inspection methods and procedures. Ultrasonic guided wave tomography (GWT) and reverse time migration (RTM) have become innovative techniques to quantify material changes in thin-walled structures such as corrosion in metallic pipes.

Research field:	Building and civil engineering and architecture
Supervisors:	Madis Ratassepp Martin Lints
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between January 02, 2023 00:00 and January 22, 2023 23:59 (Europe/Zurich)

Description

Supervisors

Main supervisor: Dr. Madis Ratassepp
Co-supervisor: Dr. Martin Lints
Co-supervisor: Dr. Jing Rao (University of New South Wales, UNSW)

The aim of this project is to investigate the performance of GWT and RTM on corrosion and other defect quantification in pipes. This requires developing advanced numerical algorithms consisting of:

1. an efficient forward solution for describing guided waves in thin-walled structures;
2. an inverse solution for the reconstruction of waveguide parameters;
3. optimization procedures to link inversion parameters with monitored structural parameters and
4. cross-correlation imaging procedure.

Finite element simulations on models of different types of damage are required to generate the input data for the imaging, with an aim to verify the detection, localization and sizing capabilities of the algorithm. These large-scale simulations are run in a computational cluster. To improve the fidelity and assess the accuracy of the modelling results, experimental validations on selected artificial and real damages in plates and pipes are needed. Such simulations and experiments require advanced experimental set-up (multi-sensor system) with novel signal processing techniques.

Requirements & Qualifications: The candidates should have Master's Degree in Physics, Mathematics, Mechanical Engineering or related field. High level of interest and motivation towards and deep understanding of computational mechanics and ultrasonics are required. A suitable background in mechanical engineering, engineering physics, applied or computational dynamics, or related disciplines is also necessary. Candidate should be willing to work using a computational cluster. Experience with Matlab, Python or related scripting or programming language is beneficial. It is advantageous if candidates have previous experience in theoretical mechanics, finite element modelling or finite difference methods and testing in ultrasonics. The candidates should also have good English writing and communication skills.

Employment: The position is at the Tallinn University of Technology and may include work as a teaching assistant in our courses. The expected duration of doctoral studies is four years, but a contract is first made for one year, and the extension is subject to the advance of studies and research. The salary is according to the salary system of Tallinn University of Technology.

How to apply for a doctoral candidate position

The application material includes:

1. Motivation letter (maximum one A4 page, important: provide clear, but honest, evidence of your skills related to the job description and requirements above)
2. CV and other proof of scientific activity (publications, conference papers etc.)
3. A certified copy of the master´s degree certificate and an official transcript of records, and their translations, if the originals are not in English.
4. An English abstract or summary of the MSc thesis.
5. Introducing two referees who can be contacted, directly.
6. Proof of proficiency in English

Further information

Job location is in Tallinn, Estonia.

For additional information, please contact Senior Researcher Madis Ratassepp (email: madis.ratassepp@taltech.ee).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/608 or scan the the code on the left with your smartphone.