Quantitative guided wave tomography for monitoring of thin-walled structures

Summary

School of Engineering, Department of Civil Engineering and Architecture offers a 4-year PhD position in mechanical engineering.

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 June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

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) has become an innovative technique to quantify material changes in thin-walled structures such as corrosion in metallic pipes. The aim of this project is to investigate the performance of GWT on corrosion 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; and (3) optimization procedures to link inversion parameters with monitored structural parameters. Finite element simulations on models of different types of damage are required to generate the input data for the tomography, with an aim to verify the detection, localization and sizing capabilities of the algorithm. 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 experiments require advanced experimental set-up (multi-sensor system) with novel signal processing techniques.

Qualification

The candidates should have Master's Degree in Physics or Mechanical Engineering.

The applicants should fulfill the following requirements:

- 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.
- It is advantageous when candidates have previous experience in finite element modelling or finite different methods and testing in ultrasonics.
- The candidates should also have good English writing and communication skills.

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