

Investigation of microcracks in PVC water pipelines using the non-collinear wave mixing technique

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The consequence of early stages of degradation in PVC is the formation of microcracks. The aim of the master assignment is to investigate the possibility of detecting microcracks in PVC using the ultrasonic technique of non-collinear wave mixing [1, 2]. The methodology includes the following steps: carrying out measurements, data processing, gaining insights and drawing conclusions about the presence and characteristics of microcracks in the PVC specimen.

Main characteristics of test setup

- Immersion test setup
- Degraded PVC pipe segment of a specific thickness
- Single element transducers mounted on rotary stages of 1 MHz central frequency
- Phased array sensor mounted on a rotary stage of 2 MHz central frequency, 32 elements, 0.5 mm pitch, 15 mm elevation

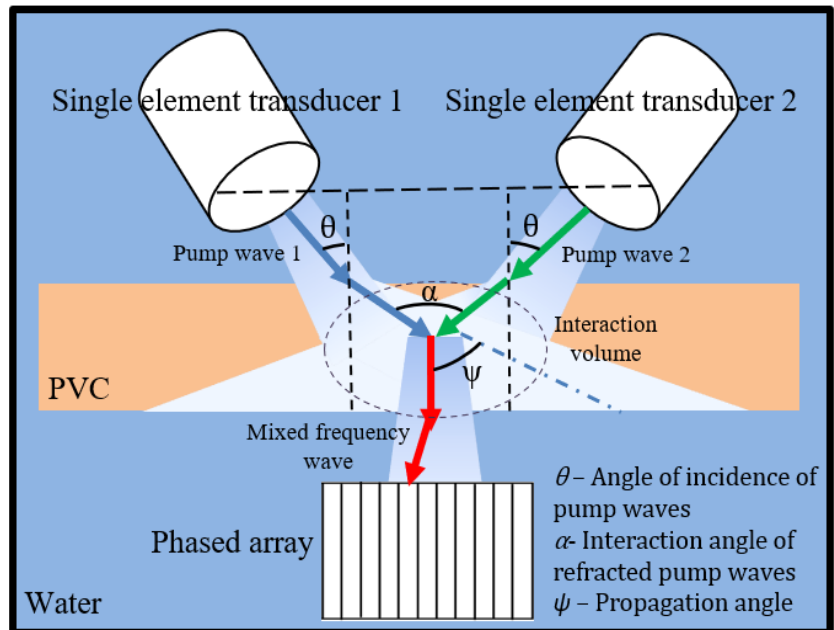


Figure 1: Non-collinear wave mixing test setup

Research objectives

- Gaining insights on the non-linearity in PVC based on the recorded mixed frequency signal to evaluate microcracks.
- Gaining insights on the type of degradation in PVC (uniform/non-uniform) based on the distribution and the nature of the microcracks.
- Validating the conclusions about the presence of microcracks in PVC using a visualisation method. Examples: Radiographic testing (RT), Scanning Electron Microscopy (SEM)

Note:

Final research objectives will be decided after discussion with student. Flexibility in adapting research questions.

Requirements

- EU master student (in Netherlands or abroad) or Non-EU master student enrolled in a Dutch university.
- A highly motivated, enthusiastic and proactive student with an aptitude for building test setups and carrying out measurements.
- Preferably with a background in acoustics, electronics or mechanical engineering.
- Experience in working with data processing software packages such as MATLAB or PYTHON

Our offer

- Chance to work in a versatile project in a great social environment with Dutch water companies interested in your work
- Chance to work in a multidisciplinary and international environment at Wetsus, and in the water pipeline inspection company Acquaint B.V. in Leeuwarden, Netherlands
- Monthly allowance: 175 Euros
- Starting Date: From October 2021
- Duration: 7 - 8 months (master assignment)

How to apply

If you are interested to know more about the master assignment, please send an email to any of the following email ID's.

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1. A J Croxford, P D Wilcox, B W Drinkwater and P B Nagy, 'The use of non-collinear mixing for ultrasonic detection of plasticity and fatigue', The Journal of Acoustical Society of America, Vol 126, No 5, pp EL117-EL122, 2009.

2. H H Delgadillo, R Loendersloot, D Yntema, T Tinga and R Akkerman, "Steering the propagation direction of non-linear acoustic wave in a solid material", Ultrasonics, Vol 98, pp 28-34, 2019.