

Notch detection in copper tubes immersed in water by a compressional guided waves

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Abstract: Tube- or pipe-like structures are used to convey fluids such as gas, oil or water. These fluids can be transported on land, in sea or in industrial buildings. Hence, tubes can suffer from mechanical, thermal and chemical stresses. The latter, can severely damage these structures due to the oxidation phenomena. This damage weakens the structure and reveals cracks and inhomogeneities. The objective of this work is to detect and characterise damage in tubes immersed in water by a non-destructive method. This research work is devoted to the development of an experimental device. This device can detect and locate axy- and nonaxy-symmetric circumferential small notches located on the outer surface of a filled tube and immersed in water using guided waves. Different sizes of notches are milled into copper tubes with a thin wall are considered. A single transducer is used for emission and reception of leaky guided waves by using the pulse-echo technique. The compressional L(0,2) mode is launched at relatively high frequency using oblique incidence of the transducer into the fluid. By using the wave leakages, notches of small sizes are detected and located. In addition, the sensitivity of the L(0,2) mode to the radial depth and circumferential extent of notches is evaluated. A roughly linear behaviour of the amplitude reflection coefficients is revealed which is in accordance with research works found in the literature.

Keywords : guided waves, Immersed tubes, Circumferential notches, Experimental device