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Verification of various leak detection algorithms based on flow dynamics model using liquid transmission pipeline prototype

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Abstract: Liquid transmission pipelines are equipped with leak detection systems (LDS) which in most cases are developed with the use of so-called internal methods. The most advanced internal methods are considered the ones that are based on the use of process dynamics models. Such internal methods are especially useful in reference to complex flow conditions. In order to improve efficiency, such advanced internal methods implemented on real pipelines should be tuned and tested with the wide range of operational conditions and various leakages characteristics. In many cases the testing of elaborated procedures on real pipelines is not possible and dangerous. On the other hand, the tests consisting in the use of data acquired from pipeline simulators are not good solution because the problems concerning fully and explicit mapping of flow phenomena. This paper focuses on experimental verification, commonly used as well as modified by author leak detection algorithms which are based on the use of process dynamics models. The experiments carried out on a laboratory water pipeline. The pipeline is 380 meters long and is made of polyethylene (PEHD) pipes. The tests were conducted including typical operational conditions of the pipeline with the wide range of their change as well as various leakages characteristics. Many aspects related to the use of process dynamics models are considered, i.e. different structure and model description, estimation of unavailable (not acquired from the measurement) state variables and friction coefficient, as well as adaptive alarm threshold selection.

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