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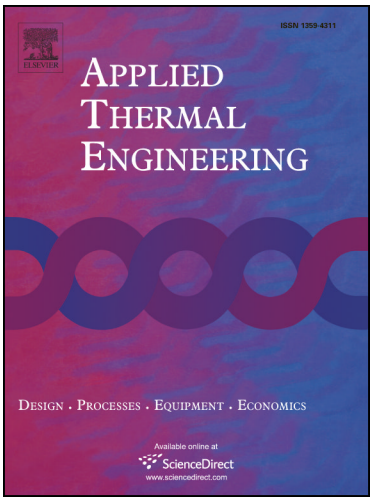

A review of leakage detection methods for district heating networks

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ACCEPTED MANUSCRIPT

A Review of leakage detection methods for district heating networks

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HIGHLIGHTS:

- The differences between district heating networks, oil/gas networks, and water distribution networks are presented.
- The current leakage detection methods of district heating networks are classified into three categories.
- Merits and demerits of the three kinds of leakage detection methods are analyzed.
- A hybrid leakage detection strategy is suggested to adapt different features of primary and secondary networks.

ABSTRACT: To investigate effective and low-cost leakage detection (LD) methods for urban district heating (DH) networks with an extensive literature review, this paper first classifies the existing methods based on their technology characteristics into three categories: physical model-based methods, data-driven methods and unmanned airborne infrared thermography (UAIT) methods, then analyzes and discusses these three methods in detail. Considering the similarity between oil/gas pipelines and water distribution networks to DH networks, the common LD methods for oil/gas and water applications are briefly summarized at the beginning. Key findings from this critical literature review include: 1) a need exists to explore new approaches for the physical model-based method to obtain a more accurate network model; 2) exploring new algorithms for the data-driven method to analyze network leakage through inadequate information is suggested; 3) optimizing the deployment of monitoring instruments is recommended, and 4) the UAIT method needs research into effective algorithms of classification and recognition, automatic post-processing, and obtaining high-quality images of varying site environments. Furthermore, a hybrid LD strategy is proposed to integrate the physical model-based and data-driven methods to adapt different characteristics of the primary network and secondary network with combining SCADA (Supervisory Control and Data Acquisition) monitoring data.

Keywords: District heating network; Leakage detection; Physical model-based method; Data-driven method; Unmanned airborne infrared thermography method.

1. Introduction

Leakage is the main problem that influences the operational safety of pipelines. A large number of media leakages results in economic and environmental disasters. The main reasons for pipeline leakage include corrosion [1], equipment ageing, mechanical impacts, etc. [2]. Although the operational conditions inside and outside pipelines can be improved to reduce the leakage risk by promoting proactive construction and operation management, local leakages are still inevitable during extended operation as the pipeline performance degrades over the time. Therefore, an early leakage diagnosis is highly significant in practice that could improve operational efficiency,

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