Image fusion method for underground pipeline leakage detection

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The water supply network is closely connected to all aspects of society. Acoustic methods could be applied to underground pipe network monitoring and leakage detection through measurements using

acoustic/vibration sensors either installed along the pipeline or on the ground surface.

Cross-correlation methods have been most widely used to detect and locate leaks in water supply pipelines. However, they are not applicable to multi-leakage detection.

Researchers from the Institute of Acoustics (IOA) of the Chinese Academy of Sciences investigated the dispersion and radiation characteristics of the leakage signals in water supply pipes. They proposed the acoustic method for locating buried pipes based on ground surface vibration measurements in their earlier work.

Following the same principle, they found that the axisymmetric fluid-borne wave was the main carrier of acoustic energy at low frequencies, which could radiate and propagate to the ground surface once leakage occurs.

In the current work, the IOA team, in collaboration with researchers from Tsinghua University, proposed an image fusion method for underground pipeline leakage detection and carried out experimental study of image fusion of ground surface vibration for mapping and locating underground pipeline leakage.

The researchers adopted tri-axial geophone sensor array to measure the ground surface vibration and extracted the magnitude information to determine the position of leak source. They also exploited the image fusion and incorporated it into the vibroacoustic technique to map the ground surface vibration, thereby demonstrating a feasible approach for remote sensing and locating multiple leaks.

They obtained the magnitude contour plots by analyzing the characteristics of acoustic wave propagation of leak signals. The

connected graph traversal method was subsequently introduced in the process of image [fusion](), revealing the suspected leakage area and leakage position.

The experimental results showed that the proposed method offered a potential improvement over the conventional vibroacoustic technique for automatically mapping and locating the suspected leakage area, which was beneficial to the practical application.

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