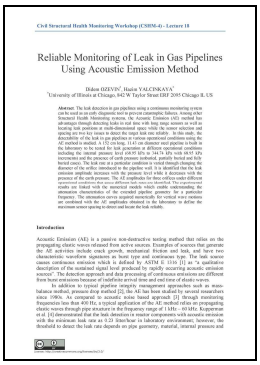

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Reliable Monitoring of Leak in Gas Pipelines Using Acoustic Emission Method

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The leak detection in gas pipelines using a continuous monitoring system can be used as an early diagnostic tool to prevent catastrophic failures. Among other Structural Health Monitoring systems, the Acoustic Emission (AE) method has advantages through detecting leaks in real time with long range sensors as well as locating leak positions at multi-dimensional space while the sensor selection and spacing are two key issues to detect the target leak rate reliably. In this study, the detectability of the leak in gas pipelines at various operational conditions using the AE method is studied. A 152 cm long, 11.43 cm diameter steel pipeline is built in the laboratory to be tested for leak generation at different operational conditions including the internal pressure level (68.95 kPa to 344.74 kPa with 68.95 kPa increments) and the presence of earth pressure (unburied, partially buried and fully buried cases). The leak rate at a particular condition is varied through changing the diameter of the orifice introduced to the pipeline wall. It is identified that the leak emission amplitude increases with the pressure level while it decreases with the presence of the earth pressure. The AE amplitudes for three orifices under different operational conditions that cause different leak rates are identified. The experimental results are linked with the numerical models which enable understanding the attenuation characteristics of the extended pipeline geometry for a particular frequency. The attenuation curves acquired numerically for vertical wave motions are combined with the AE amplitudes obtained in the laboratory to define the maximum sensor spacing to detect and locate the leak reliably.

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Ключевые слова:

Содержание