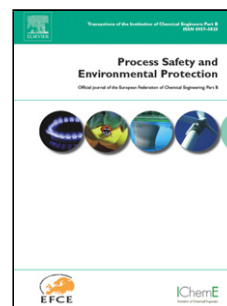


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# Natural gas pipeline safety monitoring technique based on chaotic characteristics of the detected signals

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## Highlights:

- The technique can locate both hydrate plugging and leakage.
- The accuracy of multiple positioning is good.
- The size of hydrate plugging and leakage can be estimated.
- Hydrate plugging and leakage can be distinguished using chaotic analysis method.

## Abstract

Hydrate plugging and leakage are big issues in natural gas industry which can lead to huge economic costs, serious environmental destruction and life loss. In this paper, the acoustic reflection theories for leakage detection are studied and the chaotic characteristics of the detected signals are analyzed to distinguish hydrate plugging and leakage. A monitoring prototype system has been built for trials, in which incident acoustic waves are emitted into a pipeline by a transmitter and reflected waves caused by hydrate plugging or leakage are acquired by a receiver near the transmitter and amplified for further analysis. The experimental results demonstrate that the system can detect and locate both hydrate plugging and leakage at multiple positions online with good accuracy. Signal analysis results indicate that the difference in the chaotic characteristics of the detected signals for hydrate plugging and leakage could be used to distinguish the two types of abnormal events.

**Keywords:** Natural gas pipeline safety monitoring; Hydrate plugging; Leakage; Acoustic; Chaos

## 1. Introduction

Because of its economy, high efficiency and safety characteristics, pipeline is one of the most important transportation means in the natural gas industry, especially for the connecting of natural gas resource and market [1]. In order to meet the rapidly growing demand for natural gas, the construction

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