SOFTWARE-BASED PIPELINE LEAK DETECTION*

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Pipeline leak detection has been a focus of numerous researches in industry. There are several methods based on both the expensive hardware and the inadequate software techniques. Instrument biases greatly affect the leak detection methodology, leading to high rate of false alarms or omitted leaks.

As an alternative, a less costly software based method is being proposed. The method takes into account the effects of errors in the form of leaks and instrument biases on the system. It makes use of the measured flows and pressures to infer through data reconciliation and bias detection methodologies whether a leak or a bias is present.

In this report, the Generalized Likelihood Ratio (GLR) method proposed by Narasimhan and Mah (1987) is adapted to combine leak detection and instrument bias identification. The methodology is entirely implemented within a simulator.

The earlier form of the generalized likelihood was tested on a steam metering network to test the limits of the method. 15000 iterations were performed for biases of varying magnitudes in different streams, with meter variances of 1%, 3% and 5%. As the magnitude of the simulated bias increases the accuracy of the GLR method increases. More accurate flow meters with a lower meter variance are able to correctly identify smaller biases.

Pressure measurements were introduced into the model and the entire methodology was implemented in a simulator by minimizing a data reconciliation problem using an optimizer. For perfect measurements, the model accurately located the bias perfectly. Random variances were introduced into the system. The trend was similar to that of the earlier network in that the error in bias detection reduced as the magnitude of the bias increased.

The GLR method is therefore a sufficient leak detection strategy and its accuracy is increased with better instrumentation.

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