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خلاصه مقاله:

Inverse Transient Analysis (ITA) is a powerful approach for leak detection of pipelines. When the pipe transient flow is analyzed in frequency domain the ITA is called Inverse Frequency Response Analysis (IFRA). To implement an IFRA for leak detection, a transient state is initiated in the pipe by fast closure of the downstream end valve. Then, the pressure time history at the valve location is measured. Using the Fast Fourier Transform (FFT) the measured signal is transferred into the frequency domain. Besides, using the transfer matrix method, a frequency response analysis model for the pipeline is developed as a function of the leak parameters including the number, location and size of leaks. This model predicts the frequency responses of the pipe in return for any random set of leak parameters. Then, a nonlinear inverse problem is defined to minimize the discrepancies between the observed and predicted responses at the valve location. To find the pipeline leaks the method of Particle Swarm Optimization (PSO) is coupled to the transient analysis model while, the leak parameters are the optimization decision variables. The model is successfully applied against an example pipeline and in both terms of efficiency and reliability the results are satisfactory.

کلمات کلیدی:

leak detection, inverse transient analysis, frequency response, particle swarm optimization.

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