
燃气管线漏失检测技术研究

摘要

我国天然气的使用量正逐年递增，因为使用量大，所以在输送燃气时采用成本较低、更为便捷的管线运输的方式。大部分管线一般埋于地下，在长时间使用时会因受到自然破坏、管线受到腐蚀和人为损坏等原因会造成管线泄漏。发生泄漏后会影响到百姓的生活，造成污染环境、浪费资源等多种损失。为了减少这些事故的发生，必须掌握检测管线漏失的方法。

首先，根据给出的假设条件，建立连续性方程、能量方程、运动方程，并应用 BWRS 状态方程结合热力学关系计算压缩系数、密度和焓等燃气的物性参数。其次，基于以上研究建立瞬态数学模型，选择中心隐式有限差分法将瞬态模型进行差分；差分之后的瞬态数学模型变为非线性方程，再使用广泛采用的牛顿-拉夫森方法进行迭代求解。最后，根据漏失量和泄漏点位置对管线流动参数的影响得出在首末端压力比不同时地燃气管道应测量不同的流量参数（压力或流量）进行泄漏检测，并结合假设检验进行漏失检测。

关键词：燃气管线；瞬变模型；漏失；检测

Abstract

The use of natural gas in our country is increasing year by year. Because of the large amount of use, it is cheaper and more convenient to use pipeline transportation when transporting gas. Most pipelines are generally buried underground, which can cause pipeline leakage due to natural damage, corrosion and man-made damage during long-term use. After a leak occurs, it will affect the lives of the people and cause various losses such as environmental pollution and waste of resources. In order to reduce the occurrence of these accidents, it is necessary to master the method of detecting pipeline leakage.

First, according to the given assumptions, establish the continuity equation, energy equation, motion equation, and apply the BWRS equation of state combined with the thermodynamic relationship to calculate the compression coefficient, density and enthalpy and other gas physical parameters. Secondly, based on the above research, a transient mathematical model is established, and the central implicit finite difference method is used to differentiate the transient model; the transient mathematical model after the difference becomes a nonlinear equation, and then iterate using the widely used Newton-Raphson method Solve. Finally, according to the effect of leakage volume and leakage point position on pipeline flow parameters, it is concluded that the gas pipeline should measure different flow parameters (pressure or flow) when the pressure ratio at the first end is different, and then perform leakage detection in conjunction with hypothesis testing.

Key words: Gas pipeline; Transient model; Leakage; Detection

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