

Technical Assessment of Isothermal and Non-Isothermal Modelings of Natural Gas Pipeline Operational Conditions

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Abstract

Modeling of equipment in a gas pipeline was performed here by deriving a new form of conservation equation set for compressible flow. Then a section of the third Iranian gas transmission pipeline (Nourabad-Pataveh-Dorahan, N-P-D) was investigated by isothermal (IT) and non-isothermal (NIT) modeling approaches taking into account the effects of ground temperature. In the first part, the steady state operation of the N-P-D pipeline including a compressor station at Pataveh was studied. For the known values of natural gas mass flow rate, and inlet/outlet gas pressures at Nourabad/Dorahan points, the IT and NIT modelings showed about 33.7%, 16.6% and 23% maximum difference percent points for the compressors head, compressors rotational speed and fuel consumption rates respectively. In the second part, the unsteady operation of the N-P-D pipeline due to the shutdown of a compressor at Pataveh compressor station (PCS) was studied. The results confirmed that at lower ground temperatures (0 and 20°C), the remaining compressors could compensate the loss of one compressor. However, at higher ground temperatures (40 and 50°C), the compressors had to run faster than the highest permissible speed to be able to deliver a certain mass flow rate without reducing the required pipeline pressure. In all above studied cases the computing time for the non-isothermal modeling was about three times longer than that for the isothermal one.

Keywords: Natural gas transmission pipeline, Isothermal and non-isothermal modeling, governing equations, ground temperature.

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