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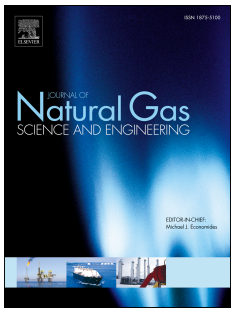

Intrinsic availability assessment of aged gas transmission pipeline using bayesian update and stochastic process modeling

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Intrinsic availability assessment of aged gas transmission pipeline using bayesian update and stochastic process modeling

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Abstract – Gas pipelines are complex and sensitive structures within gas systems. Gas pipeline networks encompass mainly compression stations and pipelegs. Compressor stations, on the other hand, includes several compression units installed, in most cases, in passive redundancy. Pipeline availability modeling is an important process during operation and design phases. It has been the purpose of many works. The majority of the published papers considered the long distance lines and compressor stations as separate systems. Only few articles treated them as a single asset and the consequences predicted by these models showed close similarities with operational data from recently commissioned pipelines. However, applying these models to aged pipelines indicates too optimistic results due to limited and simplified assumptions.

For Complex Systems Availability Modeling such as transmission gas pipelines, the main drawbacks are difficulties related to the huge dimensions of space of phases. In this paper, to reduce the space to manageable dimensions, a systemic decomposition and reconstruction approach is used. To deal with operating constraints related to aging, a Bayesian approach is developed to estimate the reliability rates of equipments operating at the same conditions but ageing differently. The probability generating method is introduced to take into account the case of unequal ageing or Compressor Stations commissioned at different dates. More the asset is aged more imperfect permutation of standby machines is omnipresent and spare parts availability become random. These assumptions are updated in a detailed Markov process model, used to define probabilities of failure states of compression units.

Keywords: Availability, Gas pipeline, Systemic decomposition, Bayesian estimation, Markovian process modeling.

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