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Estimation of failure probability of oil and gas transmission pipelines by fuzzy fault tree analysis

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Abstract

Failure of oil and gas transmission pipelines was analyzed by fault tree analysis in this paper. According to failure modes of pipeline: leakage and rupture, a fault tree of the pipeline was constructed. Fifty-five minimal cut sets of the fault tree had been achieved by qualitative analysis, while the failure probability of top event and the important analyses of basic events were evaluated by quantitative analysis. In conventional fault tree analysis, probabilities of the basic events were treated as precise values, which could not reflect real situation of system because of ambiguity and imprecision of some basic events. In order to overcome this disadvantage, a new method was proposed which combined expert elicitation with fuzzy set theories to evaluate probability of the events. As an example, failure probability of pipeline installation was assessed by using the proposed method, achieving its fuzzy failure probability of $6.4603\tilde{A}\text{---}10^{\hat{a}^{\wedge}3}$. The method

given in this article is effective to treat fuzzy events of FTA.



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Keywords

Oil and gas pipeline; Fault tree analysis; Failure probability; Theory of fuzzy set; Expert elicitation

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