

Probabilistic analysis of corroded pipeline under localized corrosion defects based on the intelligent inspection tool

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Abstract: A methodology is developed in this paper to estimate the time-dependent reliability of a pipeline in Algeria, which is in exploitation from 1981 and with internal and external localized corrosion defects detected in 2009. A probabilistic approach was applied to a pipeline made of API 5L X60 steel for the long-distance transportation of natural gas (55 km), which crossing several geographical reliefs in different country areas. The analysis was carried out by taking into consideration the potential stochastic variables altering drastically the reliability of the pipeline, i.e., dimensions of the localized corrosion defects, their locations, and distribution, and the corrosion rate. The correlations between the pipeline spatial corrosion defects distribution and their dimensions, obtained by using an intelligent inspection tool are used to analyze the actual in-service corrosion attack rate and for enhancement of the accuracy of the reliability assessment. The failure scenario was considered as the moment when the pipeline operating pressure exceeds the failure pressure defined analytically in accordance with different commonly used standards. The assessment of the reliability index of the corroded pipeline subjected to internal pressure and the failure probability was done. The detailed reliability analysis is carried out by using the second order reliability method (SORM) for the basic random variables with different probabilistic density within a nonlinear limit state function. The latter is based on the limit analysis of the failure pressure model for different standards and the numerical analysis using the finite element method and ANSYS software.

Keywords : Reliability, corrosion, Inspection, FEM