**Reliability-based maintenance optimization of long-distance oil and gas transmission pipeline networks**

Bilal Zerouali a, Yacine Sahraoui b, Mourad Nahal b, Alaa Chateauneuf c

Abstract

This paper presents a maintenance model for optimal planning of pipeline network inspections subjected to corrosion and residual stress. The proposed model includes predictive degradation modeling, spatio-temporal reliability, and expected cost minimization. The pipeline networks are formed by linear segments and irregular zones such as elbows, weld joints, and flanges for putting pipes together and changing the direction of gas or liquid flow. The mean of Karhunen-Loève expansion is used to model space-variant corrosion, residual stress, and stochastic dependency in different exposure zones. Monte Carlo simulations are employed to compute the failure probability of individual components. Subsequently, a Bayesian network evaluates the failure probability of the complex pipeline network and identifies the most critical components. Depending on the objective or market demand uncertainties, a cost model is also proposed to optimize the inspection policy. The methodology is applied to a case study, and the results show that it can provide valuable insights to decision-makers to enhance complex systems' safety and reliability.