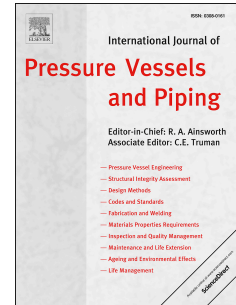


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## Bayesian Network Inference for probabilistic strength estimation of aging pipeline systems

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**Abstract:** A novel approach for reliability assessment of aging gas pipeline systems based on a Bayesian network methodology is proposed in this paper with a focus on the improvement of the pipeline strength prediction. A multimodal diagnosis is performed by assessing the variation in the mechanical property (e.g., yield strength) within the pipe in terms of material property measurements, such as microstructure, composition, and hardness. The multimodality measurements are then integrated with the Bayesian network information fusion model. Prototype testing is carried out for model verification, validation and demonstration. The model updating scheme employs a Markov Chain Monte Carlo algorithm to infer the posterior distribution of the pipe strength using the multimodality measurements, whereas, the priors are derived from the literature knowledge of such systems. Moreover, through-thickness studies of pipe cross-sections are performed to demonstrate the mechanical property variation from the surface to bulk. Finally, data training of the model is employed to obtain a more accurate measure of the probabilistic pipe strength. Discussions on the observations and future work are provided.

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