

APPLICATION OF MULTIREOLUTION ANALYSIS AND DEEP LEARNING TO OBTAIN FAILURE PRESSURE OF CORRODED PIPELINES

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Key Words: *Multiresolution Analysis, Deep Learning, Failure pressure, Corroded pipelines.*

One of the most important causes of failure and incidents in pipelines is corrosion. Due to the severe consequences and impact in several areas such as social, economic, and environment the pipelines have to be continuously monitored. The possibilities for pipelines assessment are inspection, standards, and numerical simulations.

It is well known from literature that calculations based on standards in general simple, fast, but present very conservative results. In the other hand, the finite element method has been successfully used to predict the failure pressure and it is also used in this study.

The ultrasonic technology inline inspection (UT-ILI) can provide data such as a river-bottom profile (RBP), that is a detailed two-dimensional representation of the remaining wall thickness along the pipeline. These projections are formed by the minimum values across the circumferential width. With this data we can determine the shape of corrosion formed by circumferential peak depths and the total length of the defect. As a consequence, failure pressure can be obtained through simulation with 2D- FE analysis. However, the number of thickness measurement in a RBP can be very large which is an issue to generate the required models for analysis. To overcome that, multiresolution analysis is used here to parametrize and to reduce the size of data necessary to represent the geometry of the defect.

Comparisons with experimental, semi-empirical and 3D FE were performed and good agreement were obtained with the 2d simulations based on the models from MR analysis. Moreover, to obtain fast results a deep neural network (NN) is built. For that, synthetic corrosion profiles with same statistical properties of real corrosion defects are modelled and used to compute the failure pressure by 2D FE. The coefficients of decomposition using wavelet transform and the obtained failure pressures fed the NN and after be trained this will be tested for real corrosion profiles. The results obtained for all cases considered were very satisfactory.

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