The “GEM”, a universal failure pressure model for pipeline integrity; addressing axial cracks and localized metal loss in a single model

- Based on a strong theoretical principle
- Applicable to both crack-like and metal loss flaws
- Good accuracy and precision for the Battelle NG-18 data
- Depth > 80% data is included in the validation study
- No calculation iterations, look-up tables, finite element support or duplicate “flow strength” and “toughness” calculations
- Easy to combine with other assessment methodologies
The log-secant models were derived assuming the length is the crack driving force; technically not correct for a part through-wall flaw.

The “GEM” was re-derived assuming the depth is the crack driving force; technically more correct for a part through-wall flaw.

\[
S_{fail} = S_{flow} \cdot \left(1 - \frac{a}{t}\right)^\gamma \cdot \left\{\frac{2}{\pi} \cdot \arccos \left[\exp \left(-\frac{\pi \cdot K_{mat}^2}{10 \cdot a \cdot S_{flow}^2}\right)\right]\right\}^n
\]

And...

\[
\gamma = \min\left[\frac{1}{2 - n}, \left(\frac{L}{D/2}\right)\right]
\]

The remaining ligament and Gamma Exponent terms replace the typical ASME B31G “effective area” term.

The methodology is still under development, with validation studies using in-service failure data underway.

Several conditions apply, contact IRISNDT Engineering Services for details.

For further information, visit: www.irisndt.com/ca/engineering-services/

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