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## Abstract

There have been significant advances in the development of the strain-based design (SBD) methodology from the mid-2000s to the early 2010s in anticipation of new pipeline construction in northern regions of North America. Many of the expected pipelines have not been built due to changes in producing regions. SBD has been used on smaller scales on a number of onshore projects. At the same time, strain-based assessment (SBA) has gained wider use for vintage and new in-service pipelines that were designed using traditional stress-based design.

This paper provides an overview of conceptual understandings and practical implementations of SBDA. Key steps in the strain-based design of new pipelines are covered in detail. Key concepts relevant to SBDA, such as loading modes, failure modes under tensile loading, compressive strain capacity relevant to different loading modes, and safety factors, are explained. Similarly, key steps for strain-based assessment of in-service pipelines are introduced. Features relevant to the assessment of in-service pipelines, such as the determination of strain demand, understanding key drivers to tensile strain capacity by vintage of the pipelines, welding processes and inspection practice, and detection and characterization of girth weld flaws, are highlighted.

The last part of the paper covers the gaps in the current technology and practice. These gaps must be understood to apply SBDA properly. The execution of SBDA requires collaboration among multiple functional areas of a company from an operational viewpoint. From a technical perspective, SBDA requires multi-disciplinary approaches that keep practical constraints in mind.

The focus of this paper is high-level concepts and relationships among key components in SBDA. The space limit of this paper does not permit exhaustive reviews of all relevant work carried out by many organizations. Such reviews can be found in publications by this and other authors.

**Keywords**

Strain-based design, Strain-based assessment, Strain demand, Tensile strain capacity, Compressive strain capacity, Loading modes, Failure modes under tension, Gaps in SBDA