Wang, Y.-Y., Liu, M., Status and Applications of Tensile Strain Capacity Models, Proceedings of 6th Pipeline Technology Conference, Belgium, 2013, Paper no. S13-02

Abstract

Traditional pipeline designs primarily focus on pressure containment through limiting the hop stress to a certain percentage of the specified minimum yield stress (SMYS). Strain-based design (SBD) refers to pipeline design methodologies having a specific goal of maintaining pipeline service and integrity under large longitudinal strains (typically defined as strains greater than 0.5%). At least two limit states are associated with strain-based design: tensile rupture and compressive buckling. There are two components for each limit state: strain demand and strain capacity. The strain demand is the strain imposed on the pipeline by its operational and environmental conditions. The strain capacity is the limit of the tolerable strain level beyond which a failure would occur.

This paper covers tensile strain design which has three key elements: (1) linepipe specifications/qualification, (2) girth weld specification/qualification, and (3) tensile strain models. Although the major parts of the paper are devoted to tensile strain models, the other two elements are briefly reviewed to highlight features specifically important for SBD. The fundamental principles and development process of the PRCI-CRES tensile strain models are presented. Features and input parameters are introduced for users to apply the models. The applications of the models are shown through examples. Finally the major features of the models are highlighted and the limitations of the models are clearly identified.

Keywords

Pipeline, Strain-based design and assessment (SBDA), Tensile strain models, Applications of SBDA