Yu, D., **Wang, Y.-Y.,** Chen, X., Liu, B., 2020, A Review of Pipe-soil Interaction Models for Strain Demand Estimation, Proceedings of the 13th International Pipeline Conference, Paper No. IPC2020-9678, September 28- October 1, 2020, Calgary, AB, Canada.

Abstract

Since the mid-1970s, various pipe-soil interaction (PSI) models have been developed to estimate the strain demand imposed on buried pipelines by the movement of surrounding soil. Such PSI models can be broadly divided into four categories: analytical models, soil-spring models, full continuum models and discrete element method models. These models can be used for strain-based design, fitness-for-service evaluation of in-service pipelines, and post-event failure analysis.

In this paper, the working principles and modeling characteristics of the four types of PSI models for strain demand estimation are briefly reviewed and summarized. Analytical models calculate the bending and/or membrane strains from functions that describer deflected pipe profiles. The other three types of models utilize finite element (FE) modeling to predict the pipe displacement under given soil movement patterns and calculate the strain demands, accordingly. The difference between the various PSI FE modeling techniques is attributed to the representation of the soil geometry and its interaction with the pipe in each FE modeling technique. The four types of PSI models have their own strengths and limitations, which are discussed in terms of applicability, reliability and feasibility in the present paper. The present work considers two case studies to demonstrate the potential differences in strain demand estimates using different PSI models.

Keywords

Pipe-soil interaction, strain demand, geohazard