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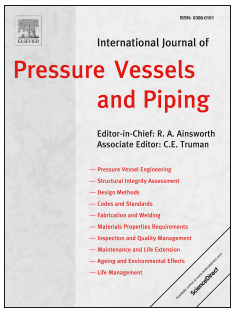

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Fracture assessment of mismatched girth welds in oval-shaped clad pipes subjected to bending moment

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Abstract

This paper provides an engineering assessment of an oval-shaped clad pipes with a circumferential part-through surface crack subjected to bending moment based upon equivalent stress-strain relationship method (ESSRM) in conjunction with EPRI *J*-estimation procedure. Plastic limit load equations are developed specially to determine the equivalent stress-strain relationship of the welded clad pipe. Then, the conventional EPRI *J*-estimation procedure is extended to calculate *J* values of the equivalent configuration with oval cross-section converted from the welded clad pipe using the ESSRM. The validation of the ESSRM/EPRI estimation framework mentioned in the above is carried out by comparing with the results obtained from 3-D elastic-plastic finite element (FE) analysis.

***Keywords*:** EPRI *J*-estimation procedure; Equivalent stress-strain relationship method; Finite element analysis; Oval-shaped clad pipe; Plastic limit load; Surface crack

1. Introduction

With increasing demand of recoverable corrosive hydrocarbons, the metallurgically-bonded clad C-Mn steel pipes with an inner corrosion resistant alloy (CRA) layer are widely used to transport these natural resources. During the installation process or in-service operation, the pipes undergo complicated loading conditions as shown in Fig. 1 [1]. They have to withstand internal pressure induced by the transported oil or gas products and external pressure exerted by the sea water. Moreover, longitudinal and transversal forces generated by seismic waves or other types of ground displacements are applied to the pipes, eventually resulting in the loading