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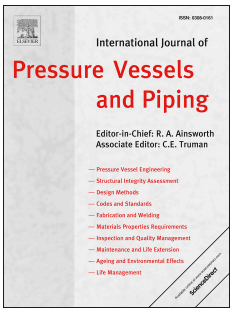

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Fatigue Reliability of Dented Pipeline based on Limited Experimental Data

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ABSTRACT: A fatigue reliability analysis of dented pipeline subjected to internal pressure load is presented based on limited experimental data. Different failure criteria considering the dent size and applied load are analysed and reliability as a function of number of load cycles is defined. The analysed pipeline is modelled as a series of segments, where any of them is characterized by the fatigue strength properties and reliability descriptors derived from the Weibull model analysis. The pipeline is assumed as a series system in which the segments, are modelled as random correlated elements. The developed approach may be used to identify practical scenarios for inspections and repair, accounting for the damage tolerance and load subjected to the pipeline.

Keywords: Pipeline; fatigue failure; structural reliability; dented pipe;

1 Introduction

The most common pipeline failure modes are associated with fatigue and buckling, which may be made more likely by local damages caused by the impact of dropping objects, excavation activities and even by corrosion degradation (Cosham and Hopkins, 2004). These types of damages may produce leaks of the pipeline leading to a financial loss and environmental impact.

Earlier studies have addressed the ultimate strength of pipelines as well as the strength of such damaged elements (Cronin and Pick, 2002, Netto et al., 2005), including reliability formulations (Caleyo et al., 2002, David and Macias, 2005, Teixeira et al., 2008).

Fatigue strength of pipelines is also a concern (Cunha et al., 2014). Much effort has been done to analyse fatigue strength of dented pipelines (Cosham and Hopkins, 2004, Cunha et al., 2009, Pinheiro and Pasqualino, 2009), where the stress concentration factors of damaged pipe sections and methods for fatigue life estimation were developed.

Fatigue is one of the most frequent modes of failure in pipelines. Very intensive work has been performed to analyse fatigue failures (ABS, 2003, Horn et al., 2012) and at the same time new requirements for new structural designs have been established (IIW, 2007). The analysis of the