# Nonlinear Analysis of Buried Pipelines Crossing Faults

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## ABSTRACT

In this paper a nonlinear analysis of buried steel pipelines crossing fault is presented. Steel pipelines have been modeled by Shell and also Beam Elements. These elements are considered to have material and geometrical non-linearities. The surrounding soil is modeled by linear springs in lateral and vertical directions and also by Solid Element. Fault displacement has been considered as target displacement and imposed to the crossing point of pipe-fault as a localized displacement.

The method which has been proposed in this article shows a step by step method for Push Over Analysis of buried pipelines crossing faults. By checking the plastic hinges, it would be possible to show whether pipeline need retrofitting or not.

The results of this article don't have any certain complexity and may easily be used in retrofitting of pipelines crossing faults.

**Key Words:** Buried Pipeline, Fault Displacement, Plastic Hinges, Pattern Load.

## 1 INTRODUCTION

Earthquake safety of utility systems and in particular buried pipelines have attracted a great deal of attention in recent years.[T.Ariman& B.-J.Lee] The most important characteristic that distinguish buried pipeline systems from other types of structures and facilities are their linearity form and overall size which cover large areas and subject to a variety of geotechnical hazards.

A pipeline system generally is built up over a large territory so that its response to permanent earthquake ground movement will be greater than that of a facility occupying a small area. Many water, oil and natural gas transmission pipelines in Iran must cross active faults like second branch of Tehran water pipeline which carry water from Bilaghan basin to Tehranparsre finery. Permanent ground movements should be considered during the design of new pipelines and for risk assessment and retrofitting strategies in existing systems. Measures for mitigating the effects of earthquake displacements should begin with understanding the principal forms of permanent movement.