Leakage Detection in Pipes

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I. INTRODUCTION

Detection of cracking and deterioration in pipes has been a frequently addressed issue in the academia and industry, primarily due to the large and common adverse effects associated with pipe leakage. Methods proposed to aid in the detection of cracks are abundant in the literature; the subject has been a major source of discussion and motivation in the past 40-50 years.

Among the methods developed for detection pipe leakage, perhaps the most promising ones are related to acoustic reflectometry and acoustic response of pipelines. The general procedure for the acoustic response procedures will be outlined in this section, and following that a similar approach that was developed in context of this topic will be presented.

II. METHODOLOGY

Using a sound emitter and a receiver at one end of a pipeline, a unit impulse acoustic signal is sent to the pipe. This impulse then propagates through the pipe and reflects back from the irregularities and these reflections are then recorded at one end of the pipeline. By looking at the magnitudes of the reflections and their arrival times, one can speculate on the nature of the discontinuities and their locations.

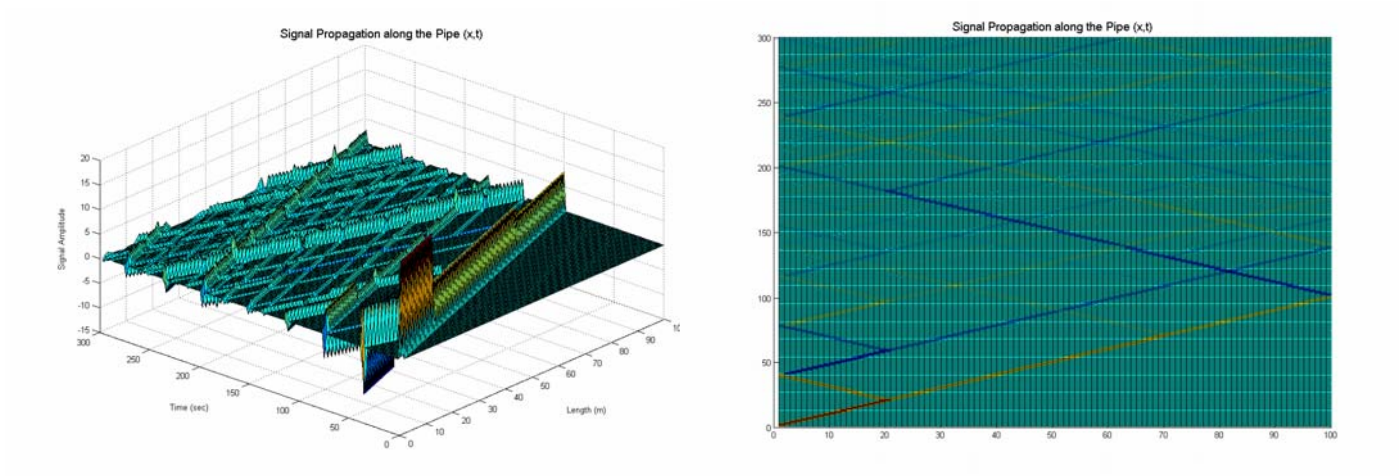

Figure 1 - MATLAB Simulation Results for the Forward Signal Propagation Problem in Pipes

III. RESULTS

In the forward problem a pipe with 3 cracks on it, is simulated. When the identified P&R ratios are compared with the actual ones results appears to be satisfactory since dramatic falls on both figures occur almost at same location points.

Figure 2 shows that all cracks can be detected in + 1.5% of the pipe length when 10-11 combinations are used. Results with more combination matrixes would lead more accurate results which we cannot get in our example due to time constraints.

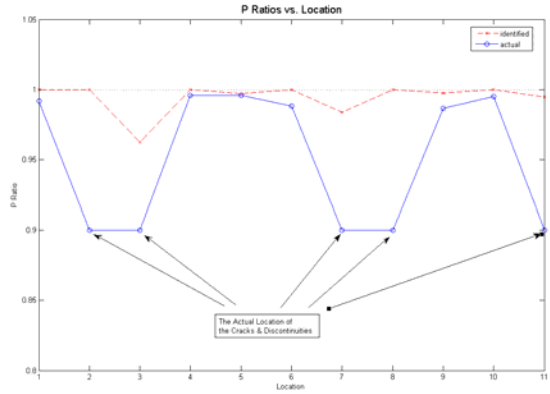

Figure 2 - Identified Cracks

IV. CONCLUSION

The algorithm developed for the detection of cracks and deterioration in pipelines seems to have the potential to be useful in accurately depicting the condition of the pipeline. In our computer experiments, we saw that the results obtained were very accurate. The crack locations and the transmission ratios obtained were very precise. We believe that the algorithm developed is very promising considering the precision it provides and the ease with which its core could be understood. We also think that the methodology developed for this purpose could also be useful in other applications such as indoor and underwater acoustics, as well as systems engineering related topics.

V. REFERENCES

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