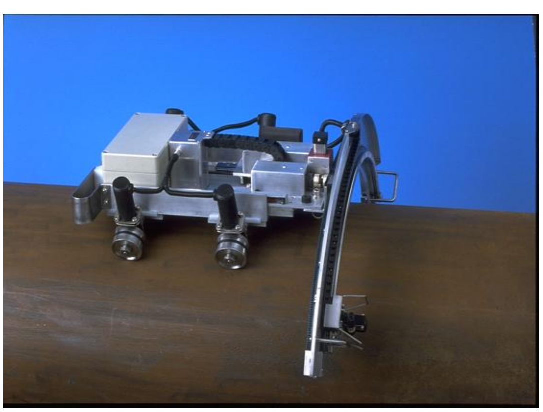
LASER BASED INSPECTION FOR WELDS AND PIPELINE CORROSION

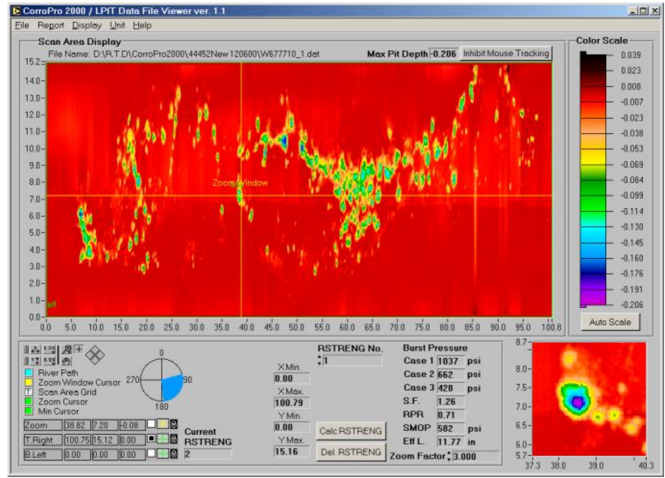
EWI TECHNICAL BRIEF

Issue
Laser scanning or laser profilometry entails traversing an area of interest with a laser sensor. The laser sensor captures two-dimension surface profiles of the area of interest and record the profiles with respect to time or distance traveled. These two dimensional surface profiles are compiled into a three-dimensional surface topography map that can be analyzed by software programs enabling precise measurement of surface imperfections or weld anomalies. Numerous laser scanning systems have been developed in recent years. A few examples of how this technology can be applied to the pipeline industry are given analyzing pipeline corrosion or analyzing welds.



Pipeline Corrosion
A majority of pipelines are continually inspected by “pigs” which internally travel though pipelines to locate corrosion damage sites. If corrosion is discovered the area needs to be analyzed to determine if the corroded pipe requires a repair. In the case of external corrosion, the areas of suspected corrosion are excavated to allow for a detailed inspection of the pipeline surface. The accuracy of the pipeline surface inspection is essential to accurately calculate the

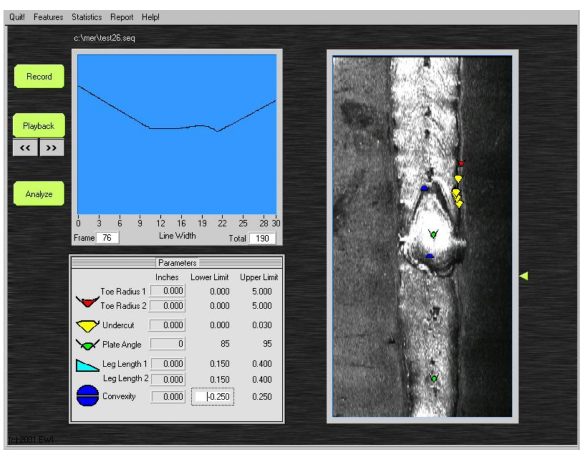
remaining strength of the pipeline and the proper course of action. In the past, the pipeline surface inspection was done manually. More recently, an automated laser scanning tool for pipeline corrosion (Figure 1) was developed to measure the extent of corrosion and provide an accurate contour map of the external corrosion of the pipe.



The software for the automated laser scanning tool distinguishes between normal pipe surface features, such as seam and girth welds, and determines the depth and severity of the corrosion. An example of a corrosion map generated by the automated laser scanning tool is shown in Figure 2.

Laser-based Weld Inspection

The most widely used welding evaluation technique is visual inspection performed by a qualified welding inspector. There are several limitations to visual inspection some of which include the subjective judgments on weld acceptability and the inspection time. These laser-based weld inspection techniques were developed to augment manual inspection by increasing the accuracy of the required measurements (e.g., bead height, undercut, weld size, etc.). In addition, the laser-based weld inspection can quickly measure up to 100% of the material surface with much higher resolution compared to competing technologies. Several laser-based weld inspection systems have been developed which include a graphic user interface (GUI) allows for easy data display, analysis, and archiving of the laser scan (Figure 3).



The laser-based weld inspection systems includes algorithms for detect and size weld defects and software that allows photograph-quality image of the scanned surface to be displayed with the suspicious areas indicated on the image. The applications for developed laser-based weld inspection systems vary and include heavy section structural weld inspection during ship construction, sheet metal arc weld inspection during automotive production, ID pipeline girth weld inspection during riser fabrication, field inspection of plastic utility pipe joints during installation, and inspection of resistance spot welds.

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