2006 Capabilities Guide

ROSEN's Geometry Inspection Tool with Extended Resolution (RoGeo·Xt) for an Accurate Determination of Dent Size and Other Geometric Properties

Introduction

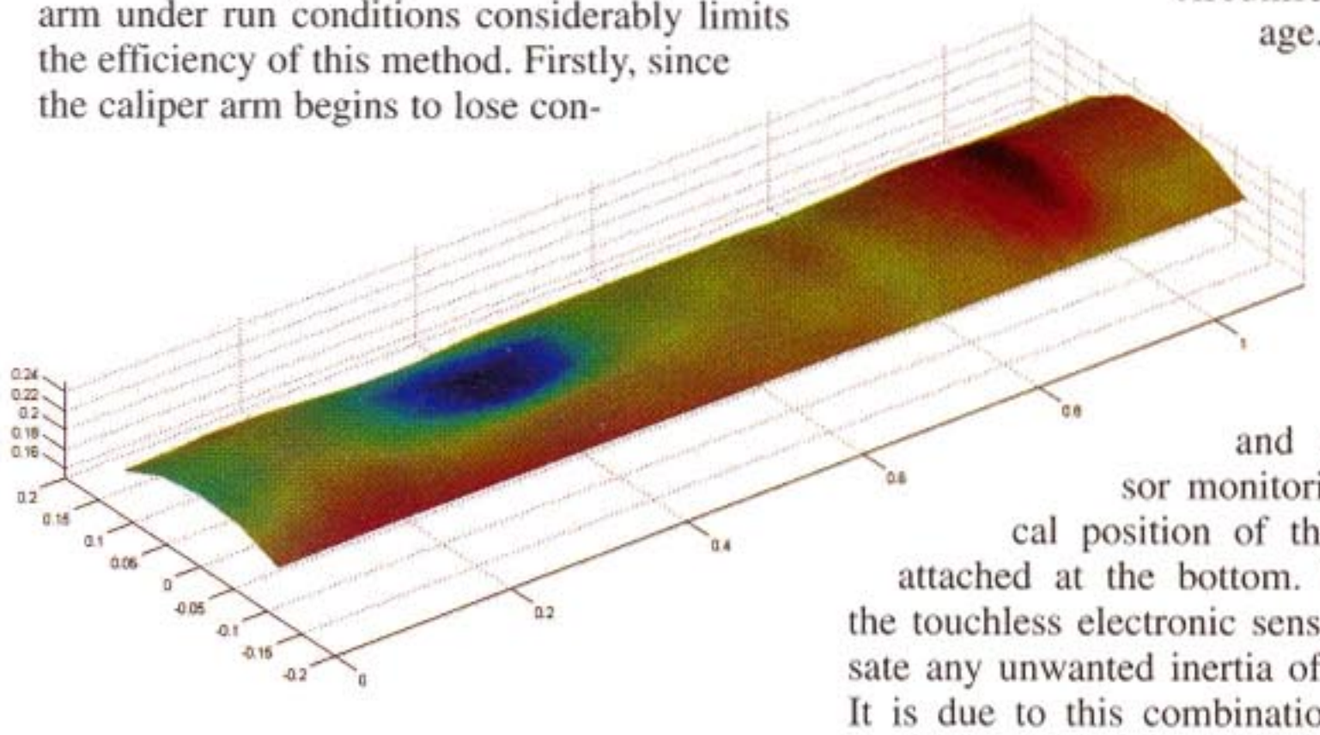
In many parts of the world, notably the USA, there is a tendency towards tighter pipeline regulations. This means that a growing number of pipeline operators need to quantify a wider range of hazards using in-line inspection (ILI). To ensure compliance with the regulations, ILI surveys must meet well-defined technical specifications which are themselves based on industry regulations and / or best practices. For example, the minimum requirement for sizing geometry defects are defined very clearly in the US Code of Federal Regulations for Transportation of Gas and Liquids (parts 192 and 195): a high-resolution geometry tool must detect and size dents with a depth greater or equal to 0.25" (6.35mm). In addition to compliance requirements, it must be possible to combine all ILI survey data with the results obtained from other types of inspection in order to extract maximum value from the available information and thus to allow integrated pipeline assessment. From an operator's point of view, ILI must, furthermore, be as economic as possible. As this brief introduction shows, the new pipeline integrity rules have great significance for in-line inspection technologies including tools for the detection of geometry defects.

Limitations of Conventional Geometry Inspection Tools

An accurate determination of dent size and other geometric properties in a pipeline requires 100% circumferential coverage by the geometry sensors of the inspection tool. Traditionally, mechanical caliper tool designs have been used for in-line inspections. This system transforms the mechanical movement of a caliper arm into a position signal which then permits operators to determine the geometric properties of the inspected pipeline. However, the dynamic behavior of the caliper arm under run conditions considerably limits the efficiency of this method. Firstly, since the caliper arm begins to lose continuous contact with the internal surface of the pipeline above a critical tool speed, this puts severe limitations on inspection speed. Secondly, even at low speeds, abrupt changes in the internal pipe surface may lead to inaccurate measurements. Attempts have been made to overcome these difficulties by means of lightweight caliper arms. Because such light arms are of necessity fragile, however, a satisfactory solution to ILI challenges purely on the basis of a mechanical design has proved elusive. As a result, the degree of accuracy provided by classic systems for the inspection of ovalities and large deformations falls short of the requirements laid down in the latest pipeline codes.

The 'Mechatronic' Design of ROSEN's RoGeo·Xt: Combining Mechanical and Electronic Measurement Systems

ROSEN's RoGeo·Xt is based on an innovative concept: it combines a traditional mechanical caliper arm with an electronic distance measurement system, thereby optimizing measurement accuracy and providing 100% circumferential coverage. This is how the 'mechatronic' solution works: a touchless sensor is integrated inside the sensor head and a position sensor monitoring the mechanical position of the sensor arm is attached at the bottom. The function of the touchless electronic sensor is to compensate any unwanted inertia of the caliper arm. It is due to this combination of two sensor units which are connected to each other that RoGeo·Xt attains 100% coverage of the internal pipeline surface. Since the non-contact electronic sensor complements data obtained from the caliper arm, even sharp transitions on the internal surface (e.g. pipe misalignment at a weld joint) are recorded accurately.



This 'mechatronic' combination produces three key benefits. First, it permits significantly higher operating speeds compared to conventional tools. Second, it gives the RoGeo·Xt Geometry Inspection Tool substantially improved measurement accuracy thus ensuring optimal contour characterization. Third, the electronic sensor is insensitive to non-conductive material. This means that recorded data invariably refers to the metal internal surface of the pipeline rather than irrelevant factors such as scale or wax debris. With these key benefits, RoGeo·Xt provides indispensable data on the geometric properties of dents and stress risers. Given that high-resolution and high-quality information about detected anomalies is an important precondition for subsequent failure analyses, RoGeo·Xt makes a vital contribution to pipeline integrity management.

A Highly Versatile and Accurate Inspection Tool

Since a maximum amount of information about potential stress factors such as corrosion is required for a full assessment of dents and other geometric properties, it can be very useful to combine geometry inspection tools with other technologies. ROSEN's RoGeo·Xt can be combined with numerous other inspection devices including EMAT (cracks), Axial Field MFL (corrosion), Transverse Field MFL (axial flaws) and Pipeline Data Logging (temperature, pressure and other physical properties). In addition, RoGeo·Xt is equipped as standard with an electronic XYZ mapping system permitting accurate navigation through the pipeline and determination of bend radii, bend length and bend direction. As is the case with all other ROSEN inspection tools, RoGeo·Xt is compatible with ROSEN's data management software package ROSOFT to ensure user-friendly and hence efficient data management, reporting and feature assessment. Apart from being highly versatile due to its compatibility with a range of other tools and custom-tailored software, the high-resolution measurements provided by ROSEN's RoGeo·Xt allow a detailed analysis of geometric defects that exceeds the requirements for dent characterization as typically required in the latest pipeline regulations.