

Methods for Identifying Weld Seams Using Fiber Optic Sensors



AI Overview

Fiber optic and optical sensors enable precise, automated inspection of weld seams, detecting defects and ensuring quality in real time. Overview of Fiber Optic and Optical Weld Sensors

Fiber optic sensors for weld seam inspection are designed to monitor and evaluate weld quality automatically, replacing or supplementing manual visual inspection. These sensors typically use laser triangulation, high-resolution imaging, or 2D/3D profiling to capture the geometry and surface characteristics of weld seams with micrometer accuracy. They are capable of detecting irregularities such as missing welds, double seams, undulations, cracks, pores, and misalignments.

Key Technologies and Methods

- 2D/3D Profile Sensors:** Systems like wenglor's weCat3D generate a 3D profile of the weld seam by scanning perpendicular to the seam. The profiles are combined in software to create a 3D image, which is analyzed for deviations from predefined tolerances. This method reduces inspection time while maintaining high accuracy.
- Laser Seam Tracking Sensors:** These sensors follow the weld seam in real time, guiding automated welders to ensure precise positioning. They measure height variations using 1D or 2D laser scans, accommodating changes in seam geometry and alignment, which improves throughput and reduces defects.
- AI-Assisted Optical Inspection:** Systems like Precitec SeamControl and IUNA AI Weld Inspector combine high-resolution imaging with artificial intelligence to detect even subtle defects on reflective or inclined surfaces. AI models classify welds as OK or NOT OK, minimizing false positives and ensuring consistent quality across production batches.
- Active Seam Detection:** Sensors from companies like Scansonic use non-contact light bars to detect joint offsets and seam edges, even in harsh industrial environments. They are robust against stray light an...

Article Content

How to Select the Right Laser Weld Seam Tracking

Namely, by accurately tracking the weld seam, the laser tracker reduces the need for manual adjustments, which leads to better positioning, faster welding, and,

All-fiber optic integration type of weld seam image sensing system

An automatic seam tracking system designed for sheet metal arc welding was constructed with a sensor. Through experiments, it was revealed that the system had an excellent seam tracking...

An image segmentation-based localization method for detecting weld seams

18 checks. Research has predominantly focused on surface imperfections of weld seams, with minimal exploration s like the seam's exact l gh erior method for accurately localizing 22 conditions of

Welding seam detection and location: Deep learning network-based ...

Abstract There are many kinds of surface defects, large difference in size and strong randomness in the process of material welding, which makes it difficult for some conventional target

Weld seam object detection system based on the fusion of 2D ...

This study introduces a novel approach that addresses the limitations of existing methods by integrating 2D image processing with 3D point cloud analysis, enhanced by interpretable

A Novel Approach to the Holistic 3D Characterization of Weld Seams ...

Therefore, it is of central importance that a scale-bridging set of information on weld seam characteristics can be obtained using suitable methods to enable an evaluation of the

Extending the Welding Seams Detection as Preparation

The novelty of the thesis lies in the fact that it uses new methods for determining the width of weld seams, which include the preparation of digital twin

Coarse-to-Fine Detection of Multiple Seams for Robotic

This paper proposes a novel framework capable of multiple weld seams extraction using both RGB images and 3D point clouds.

Automatic welding seam tracking and real-world coordinates ...

This paper introduces a cost-effective welding seam tracking model constructed using a laser line and a fixed viewpoint single RGB camera. The model's primary objective is to detect a

Weld Seam Detection 2D/3D Profile Sensors | wenglor

Weld Seam Detection on Metal Objects via 2D/3D Profile Sensors To ensure the quality of all types of welding seams on metallic objects, they must be visually

Development of an inline non-destructive monitoring

The imperfections in welded seams were identified during a continuous US welding procedure with the help of air-coupled ultrasonic sensors

An image segmentation-based localization method for detecting weld

To increase the accuracy of segmentation, we have developed a weighted dice loss function. Our methodology also includes a sliding window technique for identifying control points,

Real-Time Seam Extraction Using Laser Vision

Laser vision sensors for weld seam extraction face critical challenges due to arc light and spatter interference in welding environments.

Weld Seam Identification Using Edge Detection in Machine Vision

Abstract: In intelligent welding, achieving the automation of weld quality inspection is a significant challenge, and weld seam marking is of crucial importance. For this purpose, a method based on

3D weld seam measurement in automotive manufacturing based on ...

To meet the growing demand for efficient inspection in automotive production, this study proposes a vision-based method using structured light sensors for 3D reconstruction and precise

Visual sensing technologies in robotic welding: Recent research ...

The applications of vision sensing technologies are illustrated, especially in visual calibration, initial welding position guidance, weld seam tracking, weld pool monitoring, correlation

All-fiber optic integration type of weld seam image sensing system

Using Moiré Pattern technology, a three-dimensional welding seam image sensing system was introduced. A pair of gratings with a small angle, a CCD camera and other optical parts made

WeldNet: A deep learning based method for weld seam type

To address the limitations associated with the low intelligence of welding robots, a weld seam type identification and initial point guidance method based on deep neural network named

Coarse-to-Fine Detection of Multiple Seams for Robotic Welding

Our method is further accelerated by using a pre-trained deep learning model to ensure both efficiency and generalization ability. The performance of the proposed method has been

Weld seam object detection system based on the fusion

This research aligns with the work of 20, who explored the use of machine learning and binocular vision in robotic systems to enhance accuracy and response

Weld seam feature point extraction using laser and vision sensor

Vision sensors are used in welding seam applications for image capture and post-processing of image data. When utilized with welding robots, it is essential for establishing control

An image segmentation-based localization method for detecting weld seams

Our methodology also includes a sliding window technique for identifying control points, which ensures smoother and more consistent localization of weld seams. The efficacy of our

Weld seam detection based on 2D image and 3D point cloud

Automatic seam detection and path planning have emerged as a prominent research hotspot. This study proposed a method for automatic robotic welding path planning.

VDA 5.3: Guidelines for Weld Seam Inspection | VITRONIC

Discover how VDA 5.3 sets new benchmarks in optical sensor standards, weld seam inspection, and automated quality assurance for the automotive industry.

Fibre-optic sensor and deep learning-based structural health

Fig. 1 shows the overview of the review on fibre optic sensors and deep learning-based structural health monitoring of civil structures, and the next segment provides a brief description of

Multiple weld seam laser vision recognition method based on the IPCE ...

For broken end weld seams, a dynamic ROI method is proposed to improve algorithm speed and obtain accurate laser stripe location during welding. The left and right weld seam edge

Sensors for Weld Seam Finding

– Laser-profile or optical triangulation sensors are commonly used for weld seam finding because they can generate precise profiles of the weld joint. –

Infrared image recognition for seam tracking monitoring during fiber ...

This paper studies the detection of weld deviation and seam tracking monitoring based on infrared sensor during high-power fiber laser welding. By using a high-speed camera to obtain molten

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