Quality systems and algorithms for assessing weld surface geometry in welded joints

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Types of weld surface defects

Examples according to Volvo STD 181-0004

Leg deviation

Undercut

Underpassed throat dimension

Weld reinforcement

Outer transition radius

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Types of weld surface defects

Examples according to ISO 5817

- Leg deviation
- Undercut
- Excessive convexity
- Toe angle
- Outer transition radius

Smooth transition

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How to measure local weld geometry?
Gage R&R- Throat thickness gauge

Go/No Go

- MS noise <30% of tolerance width
- MS noise contribution <9%

Process development

- MS noise contribution <4%


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Vision System

Perform a Measurement System Analysis (MSA) for toe radius measurement on a commercial Vision-system


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Vision System
Measurement System Analysis - Results
Algorithm
Identify transition

\[ (x_i, z_i) \rightarrow (x_{i+j}, z_{i+j}) \]

\[ t_i \times t_{i+1} > 0 \]

\[ t_i \times t_{i+1} < 0 \]
Algorithm

\[
(x_i - a)^2 + (z_i - b)^2 = r^2
\]
Algorithm output – Toe radius

The radius variation along the left weld toe

The radius along the left toe, reference block
Algorithm output – Undercut
Algorithm output – Weld quality

Example: Welded beam, specified as VC in Volvo STD 181-0004

Action required
Future: Selected weld quality is used as input. Full scan along the welded / brazed joint.

Today: Received weld quality is attempted to be measured on the final product. Few selected positions only.

Improved and early QA & control is needed

ONWELD visualization map

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Application
Thank you for your attention