Prediction Model Development of Weld characteristics by Machine Learning

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Background
- Weld characteristics are complex because of local heat inputs in welding processes.
- Many factors, e.g., welding condition, joint shape, affect the weld characteristics.
- Fast and convenient prediction method of weld characteristics is desired.

Aim
- Prediction model of residual stress distribution, which is one of the important characteristics in weld, is developed by machine learning as a study on the applicability of machine learning.
- Adaptive neuro fuzzy inference system is used as machine learning technique.

-Prediction model development of residual stress distribution-

Step 1: Data collection

Example of database of relationship between input (Heat input Q, Distance from weld line y) and output (Residual stress &sigma;) obtained by finite element analysis.

Step 2: Optimization of ANFIS structure

ANFIS structure used in this study. &mu;, w, w', f are optimized in this step.

Step 3: Output prediction model

σ = f(Q, y)

Prediction model of residual stress distribution is explicit function.

-Applicability of developed prediction model-

- Residual stress distribution obtained by the developed model (Red line) is in good agreement with that obtained by finite element analysis (True value, black line).
- Developed model can predict residual stress distribution in a shorter time than evaluation time of experiment and numerical simulation.

Publications

Summary
- Applicability of developed model of weld residual stress distribution was demonstrated.
- Developed model can predict residual stress distribution under various heat input condition in a short time.

Research outcome
- Prediction model development of weld characteristics in actual weld structures.
- Prediction model development for other weld characteristics such as deformation, strength distribution and microstructure.