University of Huddersfield Repository

Radhi, H.E. and Barrans, Simon

Comparison between multiobjective optimization algorithms

Original Citation


This version is available at http://eprints.hud.ac.uk/id/eprint/13499/

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

http://eprints.hud.ac.uk/
Optimization of Weld Geometry for Fatigue Loading

Mr H. E. Radhi
Computing and Engineering

Supervisor: Dr S. M. Barrans

Introduction
This research aims to investigate the optimum geometry of weldments created by laser welding to minimize the stress concentration and maximize the fatigue strength of the joints under combined loading. In order to achieve the goal mentioned above, the Evolutionary Multi-objective Optimization software (modeFRONTIER) integrated with a mechanical model implemented in the F. E. Code (ABAQUS) will be used.

Research Objectives
- Prepare and study mechanical properties of welded joints (tensile test, Vickers hardness, fatigue strength).
- Geometrical measurements of weldment
- Finite Element simulation of weldment by (ABAQUS)
- Performing comparative study of Evolutionary Multi-objective Optimization algorithms to identify the accuracy and efficiency of each algorithm.
- Optimization study of welded joints by integrating F. E. Code (ABAQUS) with optimization software (modeFRONTIER).

Experimental Investigation
- Material of welded joints.
- Tensile test
- Vickers hardness of base metal and (HAZ)
- Fatigue test
- Geometrical measurement of welded joints by using dental molding technique to identify the weld parameters (weld toe radius, weld toe angle, weld width)

Finite-Element models of welded joints
A parametric study has been performed to investigate the affect of
- Geometrical parameters (weld toe radius, weld toe angle, weld reinforcement and weld width)
- Load parameters (tensile and bending loads)
- Modelling parameters (arc and spline modelling of HAZ)

On elastic stress concentration factor $kt$ (SCF) in weldment.

Optimization software (modeFRONTIER)
- Performed a comprehensive comparison between multi-objective optimization algorithms (MOGA-II, ARMOGA, NSGA-II, FMOGA, MOSA, MOPSO) in mechanical, convex and concave problems.
- Different metrics are used to evaluate algorithms (Hit-rate, Convergence, Spacing metrics) and graphical representation of results.

Integration between (ABAQUS) and (modeFRONTIER)

Fig. 1 Circular arc modelling of welded joint under tensile load
Fig. 2 Spline modelling of welded joint under tensile load
Fig. 3 Flow chart of optimization process