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Numerical welding simulation — Execution and documentation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 44, *Welding and allied processes*.

Requests for official interpretations of any aspect of this Technical Specification should be directed to the Secretariat of ISO/TC 44 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

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Numerical welding simulation — Execution and documentation

1 Scope

This Technical Specification provides a workflow for the execution, validation, verification and documentation of a numerical welding simulation within the field of computational welding mechanics (CWM). As such, it primarily addresses thermal and mechanical finite element analysis (FEA) of the fusion welding (see ISO/TR 25901:2007, 2.165) of metal parts and fabrications.

CWM is a broad and growing area of engineering analysis.

This Technical Specification covers the following aspects and results of CWM, excluding simulation of the process itself:

— heat flow during the analysis of one or more passes;

— thermal expansion as a result of the heat flow;

— thermal stresses;

— development of inelastic strains;

— effect of temperature on material properties;

— predictions of residual stress distributions;

— predictions of welding distortion.

This Technical Specification refers to the following physical effects, but these are not covered in depth:

— physics of the heat source (e.g. laser or welding arc);

— physics of the melt pool (and key hole for power beam welds);

— creation and retention of non-equilibrium solid phases;

— solution and precipitation of second phase particles;

— effect of microstructure on material properties.

The guidance given by this Technical Specification has not been prepared for use in a specific industry. CWM can be beneficial in design and assessment of a wide range of components. It is anticipated that it will enable industrial bodies or companies to define required levels of CWM for specific applications.

This Technical Specification is independent of the software and implementation, and therefore is not restricted to FEA, or to any particular industry.

It provides a consistent framework for-primary aspects of the commonly adopted methods and goals of CWM (including validation and verification to allow an objective judgment of simulation results).

Through presentation and description of the minimal required aspects of a complete numerical welding simulation, an introduction to computational welding mechanics (CWM) is also provided. (Examples are provided to illustrate the application of this Technical Specification, which can further aid those interested in developing CWM competency).

Clause 4 of this Technical Specification provides more detailed information relating to the generally valid simulation structure and to the corresponding application. Clause 5 refers to corresponding

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