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Additive manufacturing — General principles — Overview of data processing

Fabrication additive — Principes généraux — Vue d'ensemble des échanges de données

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative reference **1**
3 Terms and definitions **1**
4 Data exchange **2**
4.1 Dataflow 2
4.1.1 General 2
4.1.2 Explanation of the key terms used in Figure 1 2
4.2 Data formats 4
4.2.1 General 4
4.2.2 STL 4
4.2.3 VRML (WRL) 4
4.2.4 IGES 4
4.2.5 STEP 5
4.2.6 AMF 5
4.2.7 OBJ 5
4.2.8 3MF 5
4.3 Data preparation 5
4.3.1 The importance of data quality for part quality 5
4.3.2 Export parameters 6
4.3.3 Special considerations in data processing 7
Bibliography **8**

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 261, *Additive manufacturing*, in cooperation with ASTM Committee F42, *Additive Manufacturing Technologies*, on the basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on additive manufacturing, and in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 438, *Additive manufacturing*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO/ASTM 52950 replaces ISO 17296-4:2014, which has been technically revised and renumbered. The main changes compared to ISO 17296-4:2014 are as follows:

— change of the document number to ISO/ASTM 52950;

— removal of outdated or withdrawn standards ISO 17296-4 and DIN 66301 (VDA-FS);

— revisions to Figure 1.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Additive manufacturing is used to fabricate prototypes, tools, and production parts.

This document aims to offer recommendations and advice to users (customers) and manufactures (both external and internal service providers), to improve communication between customer and supplier, and to contribute to an authoritative performance design and a smooth handling of the project.

It assumes that the reader has a basic understanding of the process flow of different additive processes. It explains the processes used in practice in only as much detail as it necessary to understand the statements.

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Additive manufacturing — General principles — Overview of data processing

1 Scope

This document covers the principal considerations which apply to data exchange for additive manufacturing. It specifies terms and definitions which enable information to be exchanged describing geometries or parts such that they can be additively manufactured. The data exchange method outlines file type, data enclosed formatting of such data and what this can be used for.

This document

— enables a suitable format for data exchange to be specified,

— describes the existing developments for additive manufacturing of 3D geometries,

— outlines existing file formats used as part of the existing developments, and

— enables understanding of necessary features for data exchange, for adopters of this document.

This document is aimed at users and producers of additive manufacturing processes and associated software systems. It applies wherever additive processes are used, and to the following fields in particular:

— producers of additive manufacturing systems and equipment including software;

— software engineers involved in CAD/CAE systems;

— reverse engineering systems developers;

— test bodies wishing to compare requested and actual geometries.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/ASTM 52900, *Additive manufacturing —General principles — Fundamentals and vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in in ISO/ASTM 52900 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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3.1
polygonization
triangulation
creating a digital model of a surface in the form of a multitude of connected polygons

Note 1 to entry: Creating a surface of connected triangular polygons is usually called triangulation.

Note 2 to entry: In additive manufacturing polygonization/triangulation is a software assisted operation used to generate a facet model from either a point cloud or a 3D CAD volume model.

4 Data exchange

4.1 Dataflow

4.1.1 General

A complete 3D data set of the part forms the basis of additive manufacturing. Most commonly, this is created by direct 3D CAD modelling. The data sets can also be generated by 3D scanned data if the parts exist in a physical form (see Figure 1).

A representation based on facets is then generated from the volume or area model through polygonization or triangulation (see 4.1.2.4) and transferred to the additive manufacturing process in a suitable data transfer format. This software-assisted process runs automatically as far as possible.

4.1.2 Explanation of the key terms used in Figure 1

4.1.2.1 3D CAD modelling (solid modelling)

3D CAD modelling is the process most commonly used during design to produce a digital 3D model. The starting point can be an idea for a product, which takes shape and becomes increasingly defined directly on the computer screen during the process, or a previously generated image of the object in the form of sketches, drawings, etc. which can be converted to 3D data through a modelling process in CAD systems. Volume can be described using two different techniques, or a combination of both. The object is either composed of basic volumes (shapes) (e.g. cuboid, wedge, cylinder, cone, sphere, and toroid) which generate the actual object via a sequence of Boolean operations, or the volume is described by its surrounding boundary surfaces and the location of the material relative to the boundary surfaces.

4.1.2.2 3D digitalization

3D digitalization is the process in which the surface geometry of a physical object is measured using appropriate hardware and software and recorded in a digital point cloud model. The objects can be manually produced or finished models which need to be copied in digital form. The use of 3D digitalization is particularly efficient if the model has empirically drafted, freeform surface areas, since these are difficult to reproduce through direct 3D CAD modelling.

4.1.2.3 Surface reconstruction

Surface reconstruction is a means of processing data generated through 3D digitalization. Starting from the computer-generated point cloud, mathematically described curves and surfaces are generated with sufficient topological information to adequately recreate the object surface. These data can then be stored separately or integrated into an existing CAD volume model. Surface reconstruction thus creates a bridge between 3D digitalization and CAD modelling.

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