NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

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Additive manufacturing - Overview of data processing

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1 Scope

This Standard specifies the basic principles of additive manufacturing data exchange, gives the terms and definitions used for the exchange of additive manufacturing information to describe the geometric shape information of parts, and outlines the file types, data formats, and uses of data exchange methods.

This Standard includes the following:

- it gives a format for realizing data exchange;

- it introduces the development status of additive manufacturing data processing;

- it outlines the current typical file format types;

- it instructs the standard user to understand the necessary characteristics of data exchange.

This Standard applies to users and manufacturers of additive manufacturing processes and software systems, and applies to all additive manufacturing processes, especially:

- manufacturers of additive manufacturing systems and equipment that include software;

- software engineers engaged in computer-aided design/computer-aided engineering (CAD/CAE);

- reverse engineering system developer;

- testers engaged in geometric shape and size inspection.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 35351, Additive manufacturing - Terminology operation of basic shapes (such as cuboid, wedge, cylinder, cone, sphere, ring).

The second is a curved surface model described by the tortuosity of the solid object and its material properties.

4.1.2.2 3D digitization (reverse engineering)

Reverse engineering is the process of measuring a physical object or model with a certain measurement method, and reconstructing the CAD model of the physical object through a three-dimensional geometric modeling method based on the measurement data. Reverse engineering is especially suitable for models drawn based on experience and containing free-form surfaces, because such models are difficult to generate directly through 3D CAD modeling.

4.1.2.3 Curved surface reconstruction Curved surface reconstruction is a means of processing data generated by 3D digitalization. Based on the point cloud generated by the computer, use sufficient topological information to generate curves and curved surfaces that can be described in mathematical language, and fully reproduce the surface of the object. These data can be stored separately or integrated into the existing CAD volume model. Use reverse engineering to build a bridge between 3D data and CAD modeling.

4.1.2.4 Polygon patching/triangular patching This method uses the 3D digitized point cloud or the 3D CAD modeling volume model to generate a volume-based surface model. The surface of the object is represented by many tiny polygonal patches. The number and size of the patch determine the accuracy of the reconstruction of the actual surface geometry, and the STL format file is finally generated.

4.1.2.5 Slicing Slicing is an essential pretreatment stage in all additive manufacturing processes. Slice the faceted volume model into several continuous layers.

Record the information contained in each layer. The slice contour data is no longer related to each other in the Z-axis direction. As a result, subsequent zooms can no longer be performed in the Z axis direction. After setting the necessary parameters (such as layer thickness), the slicing process is automatically executed by the software. Other systems require separate software to prepare and store such layer data.

4.2 Data format

4.2.1 Overview The initial graphics exchange specification IGES is a kind of CAD data exchange format. It is used for the exchange of product geometry and geometric labeling information.

4.2.5 STEP The product model data exchange standard STEP is a general interface format used to describe and exchange product model data between different CAD systems. It can exchange geometric data (such as DXF or IGES) and product data (such as color, text or layer information). All forms of CAD data models can be integrated into wireframe models, surface models or volume models through STEP.

4.2.6 AMF AMF is an XML-based additive manufacturing data file format that contains three-dimensional surface geometry description, supports color, material, mesh, texture, structure and metadata (see GB/T 35352).

4.3 Data preprocessing

4.3.1 Importance of data quality to part quality Data quality inspection and repair of geometric models based on STL datasets is a prerequisite to ensure the smooth production of high-quality parts using additive manufacturing technology. The following are things to note:

- All the surfaces of the surface model should be smoothly connected together by modification to form a model with a closed surface;

- All surfaces shall be adjusted to clearly identify the volume of the object;

- When making a triangular section, it shall not choose any auxiliary tools (such as layers, cylinders, axes, elements);

- It is best to convert the surface model to a volume model before proceeding with the polygon/triangular section.

The poor-quality data shall be repaired and confirmed. It is recommended to provide accurately dimensioned drawings.

4.3.2 STL output parameters When inputting the STL data set, the setting of the output parameters determines the accuracy of the polygon section/triangle section, and then the accuracy of the obtained geometric model. If the resolution is too low, it will affect the accuracy and appearance of the model. If the resolution is too high, it will cause the file to be too large and increase the preprocessing time of the processing may be required. In this case, when the CAD model is generated, the size of the relevant parts shall be allowed to be adjusted appropriately.

Related parties shall negotiate in advance to determine the parts to be processed.

4.3.3.2 Lightweight Some additive manufacturing technologies generally have the problem of long cycle and high cost when manufacturing large-size solid parts. Therefore, in the design stage of such products, the model shall be optimized in structure to reduce the volume and weight.

4.3.3.3 Part placement and support design The orientation of the parts will directly affect the quality and manufacturing time of the parts.

Parts may require support structures during additive manufacturing. The support structure is usually arranged before the start of manufacturing and removed after the manufacturing is completed.

User can use options in the system software or separate software tools to create support structures.

Because the design of the support structure may affect the surface quality of the part, it shall mark those parts that are not allowed to be supported (see

ISO/ASTM 52921).