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Industrial automation systems and integration — Product data representation and exchange —

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Part 42:

Integrated generic resources: Geometric and topological representation

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Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits —

Partie 42: Ressources génériques intégrées: Représentation géométrique et topologique

Reference number
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Foreword

The International Organization for Standardization (ISO) 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.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303–42 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration,* Subcommittee SC4, *Industrial data and global manufacturing programming languages.*

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration – Product data representation and exchange:*

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- Part 1, Overview and fundamental principles;
- Part 11, Description methods: The *EXPRESS* language reference manual;
- Part 21, Implementation methods: Clear text encoding of the exchange structure;

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- Part 22, Implementation methods: Standard data access interface specification;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- Part 41, Integrated generic resources: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resources: Representation structures;
- Part 44, Integrated generic resources: Product structure configuration;
- Part 45, Integrated generic resources: Materials;
- Part 46, Integrated generic resources: Visual presentation;
- Part 47, Integrated generic resources: Shape variation tolerances;
- Part 49, Integrated generic resources: Process structure and properties;

- Part 101, Integrated application resources: Draughting;
- Part 104, Integrated application resources: Finite element analysis;
- Part 105, Integrated application resources: Kinematics;
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 210, Application protocol: Printed circuit assembly product design data;
- Part 213, Application protocol: Numerical control process plans for machined parts.

The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

- Part 11 specifies the description methods;
- Parts 21 and 22 specify the implementation methods;
- Parts 31 and 32 specify the conformance testing methodology and framework;
- Parts 41 to 49 specify the integrated generic resources;
- Parts 101 to 105 specify the integrated application resources;
- Parts 201 to 213 specify the application protocols.

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Should further parts be published, they will follow the same numbering pattern.

Annexes A and B form an integral part of this part of ISO 10303. Annexes C, D, E are for information only.

Diskette

Users should note that this part of ISO 10303 comprises a diskette:
— the short names of entities given in annex A are also included on the diskette;
— the EXPRESS listings (annex C) are provided on the diskette only;
— a method to enable users to report errors in the documentation is given. Full details are provided in the file.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303–1. This part of ISO 10303 is a member of the integrated resources series. Major subdivisions of this International Standard are:

- Geometry
- Topology
- Geometric models

This part of ISO 10303 specifies the integrated resources used for geometric and topological representation. Their primary application is for explicit representation of the shape or geometric form of a product model. The shape representation presented here has been designed to facilitate stable and efficient communication when mapped to a physical file.

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The geometry in clause 4 is exclusively the geometry of parametric curves and surfaces. It includes the curve and surface entities and other entities, functions and data types necessary for their definition. A common scheme has been used for the definition of both two-dimensional and three-dimensional geometry. All geometry is defined in a coordinate system which is established as part of the context of the item which it represents. These concepts are fully defined in ISO 10303 Part 43.

The topology in clause 5 is concerned with connectivity relationships between objects rather than with the precise geometric form of objects. This clause contains the basic topological entities and specialised subtypes of these. In some cases the subtypes have geometric associations. Also included are functions, particularly constraint functions, and data types necessary for the definitions of the topological entities.

The geometric models in clause 6 provide basic resources for the communication of data describing the precise size and shape of three-dimensional solid objects. The geometric shape models provide a complete representation of the shape which in many cases includes both geometric and topological data. Included here are the two classical types of solid model, constructive solid geometry (CSG) and boundary representation (B-rep). Other entities, providing a rather less complete description of the geometry of a product, and with less consistency constraints, are also included.

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Industrial automation systems and integration — Product data representation and exchange — Part 42 : Integrated generic resources: Geometric and topological representation

1 Scope

This part of ISO 10303 specifies the resource constructs for the explicit geometric and topological representation of the shape of a product. The scope is determined by the requirements for the explicit representation of an ideal product model; tolerances and implicit forms of representation in terms of features are out of scope. The geometry in clause 4 and the topology in clause 5 are available for use independently and are also extensively used by the various forms of geometric shape model in clause 6. In addition, this part of ISO 10303 specifies specialisations of the concepts of representation where the elements of representation are geometric.

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1.1 Geometry

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The following are within the scope of the geometry schema:

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- definition of points, vectors, parametric curves and parametric surfaces;
- definition of transformation operators;
- points defined directly by their coordinate values or in terms of the parameters of an existing curve or surface;
- definition of conic curves and elementary surfaces;
- definition of curves defined on a parametric surface;
- definition of general parametric spline curves and surfaces;
- definition of point, curve and surface replicas;
- definition of offset curves and surfaces;
- definition of intersection curves.

The following are outside the scope of this part of ISO 10303:

- all other forms of procedurally defined curves and surfaces;