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

Part 104: Integrated application resource: Finite element analysis

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

Partie 104: Ressources d'application intégrées: Analyse par éléments finis

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the 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.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be the subject of patent rights. ISO shall not be held responsible for any or all such patent rights.

International Standard ISO 10303-104 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*.

This part of ISO 10303 is a member of the integrated resources series. The integrated resources specify a single conceptual product data model.

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

— Parts 11 to 14 specify the description methods;

— Parts 21 to 29 specify the implementation methods;

— Parts 31 to 35 specify the conformance testing methodology and framework;

— Parts 41 to 50 specify the integrated generic resources;

— Parts 101 to 107 specify the integrated application resources;

— Parts 201 to 237 specify the application protocols;

— Parts 301 to 337 specify the abstract test suites;

— Parts 501 to 520 specify the application interpreted constructs.

A complete list of parts of ISO 10303 is available from the internet:

<http://www.nist.gov/sc4/editing/step/titles/>

Should further parts of ISO 10303 be published, they will follow the same numbering pattern.

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

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 interpreted constructs, 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.

This part of ISO 10303 is concerned with information exchange needs of finite element analysis. Many types of analyses can be conducted to ensure the performance and integrity of a product. Different aspects of a product may be idealized and then analyzed as a continuum. Exact mathematical models for any but the simplest continuum shapes are intractable. Therefore analytical methods that represent the continuum as discrete tractable shapes are used. There are many discrete analytical methodologies, some of which are finite element, finite difference, and boundary element. This part of ISO 10303 addresses only finite element analysis.

In performing an analysis with finite element analysis methods the continuum of a product is discretized into a finite element model that consists of a mesh of points (nodes) which are connected with elements. The elements represent finite portions of the product that when connected with shared nodes collectively respond as would the entire product. The elements have associated physical and material properties. There are also coordinate systems, groups, and administrative information associated with the finite element model. Load, constraint, and analysis output control information, along with analysis selection information, are combined with the finite element model to form a complete input to an analysis. Once an analysis is performed, analysis results information may be output at the nodes and at one or more positions within an element. There may be other output information not associated with a position within the finite element model such as total strain energy.

This part of ISO 10303 specifies the resources for the exchange of the information associated with the discretized (finite element) model, and the analysis controls, boundary conditions, and analysis results information that are associated with it. It is expected that the reader of this part of ISO 10303 is familiar with finite element analysis techniques.

