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Australian Standard™

Industrial automation systems and integration—Product data representation and exchange

Part 104: Integrated application resource: Finite element analysis

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Australian Standard™

Industrial automation systems and integration—Product data representation and exchange

Part 104: Integrated application resource: Finite element analysis

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PREFACE

This Standard was prepared by the Standards Australia Committee IT-006, Information Technology for Industrial Automation and Integration.

This Standard is identical with, and has been reproduced from, ISO 10303-104:2000, *Industrial automation systems and integration—Product data representation and exchange*—Part 104: *Integrated application resource: Finite element analysis*.

The objective of this Standard is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product independent from any particular system.

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10303-42	Part 42: Integrated generic resources: Geometric and topological representation	10303.42	Part 42: Integrated generic resources: Geometric and topological representation
10303-43	Part 43: Integrated generic resources: Representation structures	10303.43	Part 43: Integrated generic resources: Representation structures
10303-45	Part 45: Integrated generic resources: Materials	10303.45	Part 45: Integrated generic resources: Materials

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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.

AUSTRALIAN STANDARD

Industrial automation systems and integration — Product data representation and exchange — Part 104: Integrated application resource: Finite element analysis

1 Scope

This part of ISO 10303 specifies the resources for finite element analysis input and output information. This includes finite element models, the analysis control information, and the analysis results. The finite element analysis information model is partitioned into four schemas: the **structural_response_definition_schema**, the **structural_response_representation_schema**, the **finite_element_analysis_control_and_result_schema** and the **fea_scalar_vector_tensor_schema**.

NOTE 1 The EXPRESS-G schema level model in Figure 1 shows the relationships of the four schemas and their relationships to other parts of ISO 10303.

NOTE 2 The following rules apply to the entire FEA information model:

— a model shall be combined with a control to produce a complete FEA input;

— a result shall be combined with a model and a control to be valid.

NOTE 3 The FEA information model includes the consideration of a multi-disciplinary analysis environment, which is presented in detail in annex E.

1.1 Analysis type scope

The following types of analyses are within the scope of this part of ISO 10303:

— linear static analysis and linear dynamic modes and frequencies analysis of general 3D stress, plane stress, axisymmetric strain, and simple plane strain, based upon h-version finite element formulation using 2D and 3D continua and embedded elements which include thick shells, thin shells, beams, and bars.

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

— linear static analysis of generalized plane strain.

1.2 Structural response definition schema scope

The following are within the scope of the **structural_response_definition_schema** of this part of ISO 10303:

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