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Space systems — Dynamic and static analysis — Exchange of mathematical models

Systèmes spatiaux — Analyse dynamique et statique — Échange de modèles mathématiques

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Contents

Page

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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14954 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

Space systems — Dynamic and static analysis — Exchange of mathematical models

1 Scope

This International Standard normalizes the exchange of mathematical models between payload contractors (PLC) and launch service providers (LSP). It identifies standard methods for modelling the dynamic behaviour of both launch vehicles (LV) and payload (PL), particularly when they are coupled prior to launch and during the early moments of the launch phase.

In standard mode, the delivered models represent dynamic and static behaviour at the launcher interface. The requirements provided in this International Standard are the minimum necessary for dynamic coupled analysis. They may not be sufficient for stress analysis. The payload models are full integrated models from the different parts of the payload under the payload contractor authority, including also their own adapter to LV interface in the case that the adapter is a part of the payload.

This International Standard does not include the validation of PL models.

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.

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

3 Terms, definitions, symbols, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
payload
system that is launched by a launch vehicle

EXAMPLES Satellite, spacecraft, space probe.

3.1.2
payload contractor
organization in charge of a payload

3.1.2
launch service provider
organization that conducts a launch with a launch vehicle

3.2 Abbreviated terms

ATM acceleration transformation matrix

CoG centre of gravity

DoF degree of freedom

DTM displacement transformation matrix

EOF end of file

ICD interface control document

LSP launch service provider

LTM load transformation matrix

LV launch vehicle

OTM output transformation matrix

PL payload

PLC payload contractor

SI International System of Units

3.3 Symbols

$\boldsymbol{A}$ acceleration transformation matrix

$\boldsymbol{C}$ damping matrix

$\boldsymbol{D}$ displacement transformation matrix

$\boldsymbol{K}$ stiffness matrix

$\boldsymbol{K}_{\mathrm{R}}$ stiffness matrix of rigid body modes, $\boldsymbol{K}_{\mathrm{R}} = \boldsymbol{\phi}_{\mathrm{R}}^{\mathrm{T}} \boldsymbol{K} \boldsymbol{\phi}_{\mathrm{R}}$

$\boldsymbol{L}$ load transformation matrix

$\boldsymbol{M}$ mass matrix

$\boldsymbol{M}_{\mathrm{R}}$ mass matrix of rigid body modes, $\boldsymbol{M}_{\mathrm{R}} = \boldsymbol{\phi}_{\mathrm{R}}^{\mathrm{T}} \boldsymbol{M} \boldsymbol{\phi}_{\mathrm{R}}$

S_{e} strain energy

q_{is} internal degrees of freedom

q_{j} degrees of freedom of the interface

$\boldsymbol{\phi}_{\mathrm{R}}$ matrix of rigid body modes

η_{k} modal coordinates