PD ISO/TS 18571:2014

BSI Standards Publication

Road vehicles — Objective rating metric for non-ambiguous signals

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 10, *Impact test procedures*.

Introduction

Computer-aided engineering (CAE) has become a vital tool for product development in the automobile industry. Various computer programs and models are developed to simulate dynamic systems. To maximize the use of these models, the validity and predictive capabilities of these models need to be assessed quantitatively. Model validation is the process of comparing CAE model outputs with test measurements in order to assess the validity or predictive capabilities of the CAE model for its intended usage. The fundamental concepts and terminology of model validation have been established mainly by standard committees including the American Institute of Aeronautics and Astronautics (AIAA),[1] the American Society of Mechanical Engineers (ASME) Standards Committees on verification and validation of Computational Solid Mechanics[2] and Computational Fluid Dynamics and Heat Transfer,[3] the Defence Modelling and Simulation Office (DMSO) of the United States Department of Defence (DoD),[4] the United States Department of Energy (DOE),[5] and various other professional societies.[19] [20]

One of the critical tasks to achieve quantitative assessments of models is to develop a validation metric that has the desirable metric properties to quantify the discrepancy between functional or time history responses from both physical test and simulation result of a dynamic system.[6] [16] [17] Developing quantitative model validation methods has attracted considerable researchers' interest in recent years.[11] [12] [13] [15] [17] [18] [23] [24] [25] [27] However, the primary consideration in the selection of an effective metric should be based on the application requirements. In general, the validation metric is a quantitative measurement of the degree of agreement between the physical test and simulation result.

This Technical Specification is the essential excerpt of ISO/TR 16250:2013[10] which provides standardized calculations of the correlation between two signals of dynamic systems, and it is validated against multiple vehicle safety case studies.

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1 Scope

This Technical Specification (TS) provides validation metrics and rating procedures to be used to calculate the level of correlation between two non-ambiguous signals obtained from a physical test and a computational model, and is aimed at vehicle safety applications. The objective comparison of time-history signals of model and test is validated against various loading cases under different types of physical loads such as forces, moments, and accelerations. However, other applications might be possible too, but are not within the scope of this Technical Specification.

2 Normative references

There are no normative references used in this document.

3 Terms and definitions

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

3.1
filtering
smoothing of signals by using standardized algorithms

3.2
goodness or level of correlation
similarity of two signals

3.3
interval of evaluation
time domain that is used to calculate the correlation between two signals

3.4
rating
rating score
calculated value that represents a certain level of correlation (objective rating)

3.5
sampling rate
recording frequency of a signal

3.6
time sample
pair values (e.g. time and amplitude) of a recorded signal

3.7
time-history signal
physical value recorded in a time domain; those signals are non-ambiguous

4 Symbols and abbreviated terms

CAE Computer-aided engineering