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Passenger cars — Validation of vehicle dynamic simulation — Sine with dwell stability control testing

Voitures particulières - Simulation et validation dynamique des véhicules - Essais de contrôle de la stabilité en sinus avec palier

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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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 33, *Vehicle dynamics and chassis components*.

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Introduction

The main purpose of this document is to provide a repeatable and discriminatory method for comparing simulation results to measured test data from a physical vehicle for a specific type of test.

The dynamic behaviour of a road vehicle is a very important aspect of active vehicle safety. Any given vehicle, together with its driver and the prevailing environment, constitutes a closed-loop system that is unique. The task of evaluating the dynamic behaviour is therefore very difficult since the significant interactions of these driver-vehicle-environment elements are each complex in themselves. A complete and accurate description of the behaviour of the road vehicle involves information obtained from a number of different tests.

Since this test method quantifies only one small part of the complete vehicle handling characteristics, the validation method associated with this test can only be considered significant for a correspondingly small part of the overall dynamic behaviour.

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Passenger cars — Validation of vehicle dynamic simulation — Sine with dwell stability control testing

1 Scope

This document specifies a method for comparing computer simulation results from a vehicle mathematical model to test data measured for an existing vehicle undergoing sine with dwell tests that are typically used to evaluate the performance of an electronic stability control (ESC) system. The comparison is made for the purpose of validating the simulation tool for this type of test when applied to variants of the tested vehicle.

It is applicable to passenger cars as defined in ISO 3833.

NOTE The sine with dwell test method described in this document is based on the test method specified in regulations USA FMVSS 126 and UN/ECE Regulation No. 13-H.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 19364, *Passenger cars — Vehicle dynamic simulation and validation — Steady-state circular driving behaviour*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1176, ISO 2416, ISO 3833, ISO 8855 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
simulation
calculation of motion variables of a vehicle from equations in a mathematical model of the vehicle system

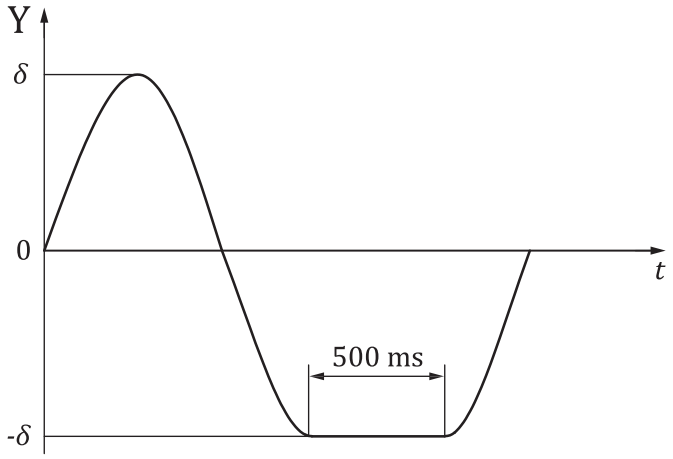
3.2
simulation tool
simulation (3.1) environment including software, model, input data, and hardware in the case of hardware-in-the-loop simulation

3.3
electronic stability control system
ESC system
control system that intervenes to maintain directional stability of vehicle and responsiveness on steering input

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3.4
sine with dwell test
test in which the vehicle is steered by a robot using a steering pattern of a sine wave at a frequency of 0,7 Hz with a delay of 500 ms beginning at the second peak amplitude

Note 1 to entry: See Figure 1.



Key
Y steering-wheel angle
t time

Figure 1 — Steering-wheel input for a sine with dwell test

3.5
sine with dwell test series
series of *sine with dwell tests* (3.4) in which the amplitude of the steering pattern is increased with each test

3.6
beginning of steer
BOS
time at which the steering begins for a *sine with dwell test* (3.4)

3.7
completion of steer
COS
time at which the steering is completed for a *sine with dwell test* (3.4)

3.8
ESC system performance standard
published standard, typically issued by a regulatory organization, that defines *ESC system* (3.3) performance requirements using a *sine with dwell test* (3.4) series

Note 1 to entry: For example, UN/ECE Regulation No. 13-H or USA FMVSS 126.

4 Principle

A sine with dwell test sequence is used to evaluate the behaviour of a vehicle with ESC. In this sequence, the vehicle is subjected to two series of tests that are run using a steering pattern of sine with dwell as shown in Figure 1. One series uses counterclockwise steering for the first half cycle, and the other series uses clockwise steering for the first half cycle.

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