INTERNATIONAL STANDARD

ISO 19364

First edition
2016-10-01

Passenger cars — Vehicle dynamic simulation and validation — Steady-state circular driving behaviour

Voitures particulières — Simulation et validation dynamique des véhicules — Tenue de route en régime permanent sur trajectoire circulaire

Reference number
ISO 19364:2016(E)

© ISO 2016



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **2**
5 Variables ... **2**
6 Simulation tool requirements ... **2**
6.1 General ... 2
6.2 Mass and inertia ... 3
6.3 Tires ... 3
6.4 Suspensions ... 3
6.5 Steering system ... 3
6.6 Aerodynamics ... 4
6.7 Brake system ... 4
6.8 Powertrain ... 4
6.9 Active controllers ... 4
6.10 Data acquisition ... 4
6.11 Driver controls ... 4
7 Physical testing ... **4**
7.1 General ... 4
7.2 Test methods ... 5
7.2.1 Constant-radius ... 5
7.2.2 Constant speed ... 5
7.3 Documentation of limit condition ... 5
7.4 Low-pass filtering of measured data ... 5
8 Simulation ... **6**
8.1 General ... 6
8.2 Simulation procedure ... 6
8.2.1 Direction of steer ... 6
8.2.2 Tests with steady-state conditions ... 6
8.2.3 Tests with slowly changing conditions ... 6
8.3 Data recording ... 6
8.3.1 General ... 6
8.3.2 Tests with steady-state conditions ... 6
8.3.3 Tests with slowly changing conditions ... 7
9 Comparison between simulation and physical test results ... **7**
9.1 General ... 7
9.2 Calculation of boundary points ... 7
9.3 Tolerances for cross-plot boundary points ... 9
9.4 Comparison of simulation cross plots with measured test data ... 9
10 Documentation ... **9**
Annex A (informative) **Combined tolerance for normalized geometric profile** ... **11**
Bibliography ... **13**

© ISO 2016 – All rights reserved

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*.

© ISO 2016 – All rights reserved

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 should include 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.

© ISO 2016 – All rights reserved

Passenger cars — Vehicle dynamic simulation and validation — Steady-state circular driving behaviour

1 Scope

This document specifies a method for comparing computer simulation results from a vehicle mathematical model to measured test data for an existing vehicle according to steady-state circular driving tests as specified in ISO 4138 or the Slowly Increasing Steer Test that is an alternative to ISO 4138. 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 Slowly Increasing Steer method is described in regulations such as USA FMVSS 126 "Federal Register Vol 72, No. 66, April 6, 2007" and UN/ECE Regulation No. 13-H, "Uniform provisions concerning the approval of passenger cars with regard to braking".

2 Normative references

The following documents are referred to in 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 4138, *Passenger cars — Steady-state circular driving behaviour — Open-loop test methods*

ISO 15037-1, *Road vehicles — Vehicle dynamics test methods — Part 1: General conditions for passenger cars*

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 environment including software, models, input data, and hardware case of hardware-in-the-loop simulation

3.3
cross plot
plot where the horizontal axis shows values for a variable other than time (e.g. lateral acceleration)

© ISO 2016 – All rights reserved