NSAI Standards

Irish Standard Recommendation
S.R. CWA 17384:2019

Articulated industrial robots - Elastostatic compliance calibration

S.R. CWA 17384:2019

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National Foreword

S.R. CWA 17384:2019 is the adopted Irish version of the European Document CWA 17384:2019, Articulated industrial robots - Elastostatic compliance calibration

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CEN WORKSHOP AGREEMENT

CWA 17384

July 2019

ICS 25.040.30

English version

Articulated industrial robots - Elastostatic compliance calibration

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

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European foreword

CWA 17384 was developed in accordance with CEN-CENELEC Guide 29 'CEN/CENELEC Workshop Agreements – The way to rapid agreement' and with the relevant provision of CEN/CENELEC Internal Regulations – Part 2. It was agreed on 2018-10-30 in a workshop by representatives of interested parties, approved and supported by CEN following a public call for participation made on 2018-09-28. It does not necessarily reflect the views of all stakeholders that might have an interest in its subject matter.

Results incorporated in this CEN Workshop Agreement (CWA) received funding from the European Union’s HORIZON 2020 research and innovation programme under the grant agreement number 723853. This CWA is based on the results of the COROMA research project.

The final text of CWA 17384 was submitted to CEN for publication on 2019-06-14. It was developed and approved by:

— Université de Nantes (Mr. Sebastien Garnier, Mr. Kevin Subrin);

— KTH Royal Institute of Technology (Mr. Andreas Archenti, Mr. Nikolas Theissen);

— Europe Technologies (Mr. Mickaël Anzemberg);

— Ideko S. Coop. (Mr. Asier Barrios, Mr. Javier Hernández); and

— University of Sheffield — Nuclear Advanced Manufacturing Research Centre (Mr. Ozan Gurdal, Mr. Benjamin Rae).

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Introduction

Industrial robots progressively complement value streams as they can realize numerous applications while providing the flexibility required in modern manufacturing environments. This can be observed across important industries for a wide variety of commodities such as consumer electronics, industrial machinery or vehicles.

The most significant disadvantages of industrial robots, when compared to specialized machinery, are their comparably lower accuracy as well as their comparably higher complexity. The lower accuracy is a result of kinematic and non-kinematic inaccuracies. Kinematic inaccuracies are a result of the imperfect geometries and dimensions of the links as well as the configurations of the joints. Non-kinematic inaccuracies can be due to several sources:

— joint and link compliance;

— thermo-mechanical errors;

— gear backlash;

— controller errors;

— wear;

— environmental influences; and

— installation errors.

One approach to partly compensate for these inaccuracies lies in manipulator calibration as described by Mooring et al. in 1991 [1]. This CWA focuses on the calibration of elastostatic compliance, i.e. the compensation of the deformation of components due to their finite stiffness under external static loads.

The information from the elastostatic compliance calibration can be implemented in industrial manipulators to reduce inaccuracies using on-line, off-line or combined compensation and control strategies. It is useful to standardize an elastostatic compliance calibration procedure to save time and cost and create the following advantages across different groups of share- and stakeholders:

— customers could benefit from a broadened range of potential applications with their existing robotic systems and subsequently an easier adaptable production system due to the flexibility of industrial robots; and

— researchers could benefit from a common understanding of the calibration procedure for the compliance of industrial robots, which facilitates the dissemination of research results and the application by researchers of other fields in synergetic projects.

Currently, it is possible to employ a wide range of methods, instruments and models to test the compliance of industrial robots. These methods have their own potential strengths and weaknesses in terms of time, cost and their ease of use. This CWA intends to provide an international mutual understanding of robotic compliance amongst customers, developers, manufacturers and researchers.

1 Scope

This CEN Workshop Agreement (CWA) intends to define one good practice elastostatic compliance calibration for articulated industrial robots using an enhanced stiffness formulation for the robot model, a pragmatic measurement approach inspired by the application and an identification of the model parameters based on position data.

The CWA compliance for industrial robots describes how it can be specified, recommends how it should be tested and outlines the potential usage of the information for industry applications. This document is intended to be used by customers, developers, manufacturers and researchers of industrial robotic systems.

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.

EN ISO 9283:1998, *Manipulating industrial robots — Performance criteria and related test methods*

EN ISO 10218-1:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots (ISO 10218-1:2011)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 https://www.iso.org/obp

3.1
articulated robot
robot (3.14) whose arm has three or more **rotary joints** (3.15)

[SOURCE: ISO 8373:2012, definition 3.15.5]

3.2
autonomy
ability to perform intended tasks based on current state and sensing, without human intervention

[SOURCE: ISO 8373:2012, definition 2.2]

3.3
base coordinate system
BCS
coordinate system referenced to the base mounting surface

[SOURCE: ISO 8373:2012, definition 4.7.2]