TECHNICAL SPECIFICATION

ISO/TS 18621-21

First edition
2020-11

Graphic technology — Image quality evaluation methods for printed matter —

Part 21: Measurement of 1D distortions of macroscopic uniformity utilizing scanning spectrophotometers

Technologie graphique - Méthodes d'évaluation de la qualité d'image pour les imprimés —

Partie 21: Mesure des distorsions 1D d'uniformité macroscopique à l'aide de spectrophotomètres à balayage

Reference number
ISO/TS 18621-21:2020(E)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

A list of all parts in the ISO 18621 series can be found on the ISO website.

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Introduction

The subject of image quality is broad and complex, due to its multidimensionality and the apparent characteristics of human vision. Many different methods can be available to provide a measure of a particular visual attribute in some particular viewing context and aimed at a particular printing technology. It is a challenge to have image quality evaluation methods that are independent of the marking technology, i.e. correlate with human perception to provide visual significance to measured differences across many printing technologies. The evaluation of perceived image quality is an active field of research.

The uniformity that can be achieved, or in fact the lack thereof, is an important factor in the evaluation of the overall print quality. Uniformity refers to the subjective impression of the homogeneity of the colour in extended areas up to the document size. Colour uniformity refers to all types of unintended but visible variations in colour, that may go in any direction in colour space and may have any spatial pattern. Spatial patterns include 1D, 2D, periodic, aperiodic, localized, large-scale and small-scale variations. They can be identified as streaks or streakiness, banding, gradients, mottle, moiré and others.

When evaluating perceived uniformity, the intended viewing distance should be taken into account. For practical application it is also common practice to distinguish 2 categories of uniformity that depend on the spatial frequency (or actually the angular frequency as seen by the eye):

— Microscopic uniformity such as graininess that is related to the imaging process and generally consists of a 2D random noise pattern. It is visually relevant for image objects as small as few square mm in size in case of normal reading distance (40 cm).

— Macroscopic uniformity involves distortions in the homogeneity that extend beyond few mm in one or both geometric dimensions. It is generally visible across the document page size with examples called banding, cording stripes or streaks.

This document focuses on the macroscopic uniformity that exhibits 1D type patterns that extend more or less across the printed area of a page. It uses well established colour measurement instruments as the basic measurement device, especially systems that can be combined with automated XY-tables for performing well defined measurements in a complete 2D grid of measurement locations in an easy way. These systems generally have a minimum pitch in both dimensions of 6 mm. This method takes a much more rigorous approach than the 9-point sample method that is defined in ISO 12647-7 that is applicable to proofing systems.

The measurement method derives a single valued Macro-Uniformity-Score on a scale that ranges from 100 (“perfect uniformity”) to 0 (“extremely poor uniformity”). It is based on the evaluation of the average colour differences that occur in horizontal and vertical rows separately and adds them up to arrive at a single value. Then a formula is applied to compute the Macro-Uniformity-Score that is shown to correlate well with the perception of representative streaks or stripes of toner-based printing systems as well as inkjet based systems.

This document describes a methodology in such a way that other documents can apply it for specific use cases. Such documents will typically need to apply additional constraints on test pages and process control in order to ensure that the resulting Macro-Uniformity-Score can be compared between different printing devices, substrates and ink sets.