
**Characterization of pavement texture by
use of surface profiles —**

Part 4:
Spectral analysis of surface profiles

*Caractérisation de la texture d'un revêtement de chaussée à partir de
relevés de profils de la surface —*

Partie 4: Analyse spectrale des profils de la surface



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Contents

Page

Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
4 Basic outline of methodologies of spatial frequency analysis.....	6
5 Sampling of surface profiles.....	8
5.1 Sampling of road sections.....	8
5.2 Measurement of laboratory samples.....	9
6 General principles and requirements.....	9
6.1 Requirements concerning profilometers.....	9
6.2 Conversion of spatial frequencies to temporal frequencies.....	9
6.3 Drop-outs.....	11
6.4 Anti-aliasing filtering.....	12
6.5 Digital sampling.....	12
7 Spectral analysis in constant-percentage bandwidth bands (octave- or one-third-octave bands) by analogue filtering (Method 1).....	13
8 Spectral analysis in constant-percentage bandwidth bands (octave- or one-third-octave bands) by digital filtering (Method 2).....	15
9 Spectral analysis in narrow constant bandwidth bands by means of Discrete (Fast) Fourier Transform methods (Method 3).....	15
9.1 Overview of methodology.....	15
9.2 Slope and offset suppression.....	16
9.3 Windowing.....	16
9.4 Discrete Fourier Transform and Power Spectral Density.....	18
9.5 Wavelength resolution.....	19
10 Transformation of constant bandwidth spectral data to constant-percentage bandwidth spectral data.....	19
11 Uncertainty of analysis results.....	21
12 Reporting of analysis results.....	22
Annex A (normative) Uncertainty of spectral analysis results.....	23
Annex B (informative) Aliasing.....	28
Annex C (informative) Estimation of the deviation in energy within a frequency band caused by variations in speed.....	30
Annex D (informative) Compensation for speed variations during processing of the measured data.....	31
Annex E (informative) Explanation of the relation between the wavelength resolution and the spatial frequency resolution.....	32
Annex F (informative) Spectral analysis and profile asymmetry.....	33
Bibliography.....	35

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 13473-4 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 13473 consists of the following parts, under the general title *Characterization of pavement texture by use of surface profiles*:

- *Part 1: Determination of Mean Profile Depth*
- *Part 2: Terminology and basic requirements related to pavement texture profile analysis*
- *Part 3: Specification and classification of profilometers*
- *Part 4: Spectral analysis of surface profiles* [Technical Specification]
- *Part 5: Determination of megatexture*

Introduction

Pavement texture is one of the basic road surface characteristics and as such is related to many functional characteristics, such as noise emission from tyre-road interaction, friction between tyre and road, rolling resistance and tyre wear.

Spectral analysis of measured surface profiles is frequently used as a method of pavement characterization. However, recent practice has shown that the methodology of spectral analysis is not sufficiently well known in the field of pavement measurements to assure reproducible results. Improvement of the reproducibility by offering guidance in the form of a standardization document seems therefore advisable.

Although the principles of frequency analysis are used in various fields of signal processing, it seems that a tailored elaboration of these principles for the application in the field of pavement texture measurements is appropriate and will enhance the use of these methods and the quality of the results achieved.

This elaboration, in the form of an ISO Technical Specification, is intended to stimulate the international exchange of knowledge and data concerning pavement characteristics.

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Characterization of pavement texture by use of surface profiles —

Part 4: Spectral analysis of surface profiles

1 Scope

This Technical Specification describes the methods that are available to perform a spectral analysis of pavement surface profile signals. It specifies three possible methods for spatial frequency analysis (or texture wavelength analysis) of two-dimensional surface profiles that describe the pavement roughness amplitude as a function of the distance along a straight or curved trajectory over the pavement.

The result of the frequency analysis will be a spatial frequency (or texture wavelength) spectrum in constant-percentage bandwidth bands of octave or one-third-octave bandwidth.

This Technical Specification offers three alternative methods to obtain these spectra:

- 1) analogue constant-percentage bandwidth filtering;
- 2) digital constant-percentage bandwidth filtering;
- 3) constant narrow bandwidth frequency analysis by means of Discrete Fourier Transform, followed by a transformation of the narrow-band spectrum to an octave- or one-third-octave-band spectrum.

The objective of this Technical Specification is to standardize the spectral characterization of pavement surface profiles. This objective is pursued by providing a detailed description of the analysis methods and related requirements for those who are involved in pavement characterization, but are not familiar with general principles of frequency analysis of random signals. These methods and requirements are generally applicable to all types of random signals, but are elaborated in this Technical Specification in a specific description aimed at their use for pavement surface profile signals.

NOTE The user of this Technical Specification should be aware that spectral analysis as specified in this document cannot express all characteristics of the surface profile under study. In particular, the effects of asymmetry of the profile, e.g. the difference of certain functional qualities for “positive” and “negative” profiles cannot be expressed by the power spectral density, as it disregards any asymmetry of the signal. (See Annex F.)

2 Normative references

The following referenced documents are indispensable for the application 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 13473-2:2002, *Characterization of pavement texture by use of surface profiles — Part 2: Terminology and basic requirements related to pavement texture profile analysis*

ISO 13473-3, *Characterization of pavement texture by use of surface profiles — Part 3: Specification and classification of profilometers*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*