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# Scale independent surface characterisation: geography meets precision surface metrology (version 2016/12/16)

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## Abstract

The recently published standard ISO 25178-2 distinguishes between *field parameters* and *feature parameters* for surface texture characterisation, whereby the main difference between these two types is due to the fact that the parameters belonging to the first group are deduced from all points of a scale limited surface, while the parameters belonging to the second group are deduced from only a subset of predefined topological surface features. As specified in ISO 25178-2, two prerequisites are indispensable for the determination of the feature parameters, viz., an adequate data structure for *surface characterisation* and a suitable formal method for *surface generalisation*, i.e. for the successive elimination of the less important surface features. Within ISO 25178-2 *change trees* are proposed for describing the surface topography, while *Wolf pruning* is suggested for surface simplification (cf. also ISO 16610-85). Apart from the techniques specified in ISO 25178-2 and ISO 16610-85, the present paper describes a second *geometrical-topological* approach for the characterisation and generalisation of surfaces that has its origin within the geosciences and is based on *weighted surface networks* and *w-contractions*. In addition, it is revealed how the two approaches, both of which have their foundations in graph theory, are inter-related to each other and how, from a historical point of view, the GIScience approach forms the basis of the one applied within surface metrology. Finally, some applications within precision engineering are described.

*Keywords:* surface generalisation, weighted surface network, Reeb graph, contour tree, change tree, Wolf pruning, ISO 16610-85, ISO 25178-2

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## 1. Introduction

Within the geographic and cartographic community, (*map*) *generalisation* is defined as the process of deriving from an original spatial database (or a map) a second spatial database (or a map) of decreased contents and complexity, but with the relevant characteristics with regard to a pre-defined objective

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