

Abstract

This doctoral dissertation introduces an alternative methodological paradigm within the domain of surface metrology, challenging the dominant dual-axis framework which primarily focuses on either the impact of surface modification processes or the optimization of specific surface functionalities. The proposed framework, conceptualized as the *Surface Information Acquisition Spectrum*, repositions surface analysis within a broader epistemological and interdisciplinary context, extending beyond the confines of industrial applications. Each chapter of this work contributes to the articulation of this new framework: Chapter 1 formulates a standardized terminological system for surface description inspired by heraldic conventions; Chapter 2 quantifies the multi-scale graphical and textual complexity of heraldic systems through bespoke mathematical models; Chapter 3 addresses digital discretization artifacts in fractal geometries, using the Von Koch snowflake as a benchmark; Chapter 4 introduces a novel method for fractal characterization of sandblasted surfaces via the Sdr roughness parameter and Gaussian filtering; and Chapter 5 extends this methodology to the topographic analysis of art objects. By integrating conceptual domains such as language theory, image syntax, fractal complexity, and surface evaluation, this research establishes the foundations for a transdisciplinary reconfiguration of surface metrology and suggests pathways for the emergence of new subfields within the discipline.

Key words: Surface topography, roughness, terminology, ontology, multiscale analysis, cultural heritage, heraldry, fractals, complexity, art, painting