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QUANTITATIVE MULTI-SCALE ANALYSIS OF SURFACE TEXTURE ANISOTROPY ON BIOLOGICAL AND ENGINEERING SURFACES

Abstract

Surfaces cover everything, and since the first standards for the measurement and characterization of surface texture were written researchers, scientists, and engineers have known that all surfaces have a directional property. This property is either an alignment of features or roughness on the surface (anisotropy,) a lack of such an alignment (isotropy,) or in most cases something in between. In the earliest standards written, this anisotropy of surfaces was characterized visually and referred to as “Lay.” This lay is almost always caused by the process that created the surface of question and can have significant impact on the surfaces performance when interacting with other surfaces in cases where fluids or partials are flowing over the surface. By the late 1900s researchers began to quantify surface anisotropy and by the year 2000 it had been established that surface anisotropy is a multi-scale phenomenon. In this work I look at and expand the state of the art in the characterization of surface anisotropy with examples from both biological and engineering surfaces. This dissertation is presented as a collection of three journal papers published between 2003 and 2006, and a fourth, which is expected be published in 2019. In the fourth paper presented in this dissertation I examine the research presented in over 800 papers published over the past fifteen years that cited the three previous works. I explain design considerations that impacted the surface roughness parameter "exact proportion length-scale anisotropy of relief" (epLsar) that was developed and first presented in the journal Nature in 2005 (Scott et. al. 2005.)