Second Derivative and Curvature of Fractal Curves

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Abstract

The theoretical objective of our work is to propose a geometric characterization of surface roughness from fractal models for 3D objects. This characterization will generate groups of geometric models (made up of curves and surfaces) of different kinds of roughness. These models are dedicated to researchers and engineers in their search for the rough surface performing optimally in numerical simulations or to evaluate the impact of roughness on the physical properties of an object. We produce roughness by fractals so that it will have self-similar geometric properties and we generate fractals using BC-IFS in order to control roughness. So our hypothesis is to study the different level of differentiability C0, C1, C2, ... in order to give this characterization. We showed in the past that the behaviour of a fractal curve can be controlled by its differential components (right and left derivatives for controlling C1 differentiability). In this work, we study the behaviour of the second derivative in order to see if we can also use it as a way to control a fractal curve, we show that the second derivative affects the nature of the curvature. Finally, we demonstrate that for some particular cases, a fractal curve has a range of curvature.

Keywords: Fractals, tangent, derivatives, differentiability, curvature.