A Random Walk Through Fractal Dimensions

Brian H. Kaye

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The rapidly burgeoning interest in fractals has led to a proliferation of books devoted to this subject. Some of these books are technical, others descriptive, but all focus on some subset of fractals that the author finds especially interesting, or with which he or she is particularly well acquainted. The ambitious, global titles given to these books thus often belie the limited topical terrain actually explored. Brian Kaye well understands that the diverse applications of fractal geometry prevent linear organization and thinking, and so has appropriately entitled his book to properly reflect the nature of this field.

From the perspective of the bicameral brain, the audience to whom this book will appeal will tend to think somewhere right of center; rather than offering a treatise on the calculus of fractal geometry, the author has demonstrated the descriptive power of fractal geometry when brought to bear upon common materials problems. In seeking to broaden the appeal of his book, Kaye has assiduously avoided the use of equations, preferring verbal explanations to the mathematical minutiae offered in much of the fractals literature. However, sufficient references are given that the fractals proselyte should have no difficulty filling in the technical details.

In applying fractal geometry to materials problems, the author has drawn heavily on his background in fine particle science. For example, methods are given for determining the profile dimension of such fine particles as diesel soot, coal dust, sponge iron, welding dust etc., and the practical limitations of these computational techniques are discussed. In addition, the fractal aspects of many fine particle problems are discussed, including fine particle production through comminution, powder mixing, spray deposition processes, fragmentation processes, filtration of fine particles, aggregation and agglomeration, pigmented coatings, dust explosions, etc. Indeed, no stone is left unturned in the quest for applications of fractal geometry to fine particle problems. Along the way the reader becomes well acquainted with the variety of interesting and challenging problems in fine particle science. This book should, therefore, be of special interest to those intent on applying fractal geometry to this area of research. In contrast, the book would not be the first choice for those trying to precisely understand such concepts as surface and mass fractals, self-affinity and self-similarity, or such advanced concepts as iterative mappings, multifractal measures, and renormalization techniques. However, this book is directed at the initiate, not the expert, and more advanced material is treated elsewhere.

The author's personal fascination with etymology provides an interesting and unusual leitmotif in this book. Such common terms as "logarithm," "capricious," and "ergodic" are shown to have interesting roots, which makes the book more interesting while only marginally increasing the dimension of this random walk (e.g., "ergodic" is derived from a Greek word meaning tiresome or boring—this may explain the unfortunate premature demise of Boltzmann). This innate interest in language also leads to the odd neologism, with terms such as "fractalicious" and "quantum geometry" appearing occasionally, and disappearing even more occasionally.

Finally, the author has highlighted some recent work on fractals in a chapter entitled "Signposts to More Rambling Explorations of Fractal Space." Herein are described a few of the applications of fractals that are unrelated to fine particles, including some helpful references. However, in this regard this book is the *alpha*, not the *omega*, and several recent review articles would augment this chapter quite well. Still, this book should provide hours of enjoyable reading to those wishing to become acquainted with the ideas of fractal geometry as applied to practical materials problems.

Reviewer: James Martin is in the Structural Physics and Shock Chemistry Division of Sandia National Laboratories, Albuquerque, New Mexico. His research interests include the structure and dynamics of disordered materials.

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