

MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

A Workshop on Future Directions in Fractional Calculus Research and Applications

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A Stranger in a Strange Fractional Calculus Land

Abstract

Fractional Calculus (FC) started with the standard differential calculus, but remained an obscure topic during several centuries. The present day popularity of FC in the scientific arena, with a growing number of researchers and published papers, makes one forget that 20 years ago the topic was considered “exotic” and that a typical question was “FC, what is it for?”

Present day popular directions of progress are new definitions of operators and “fractionalization” of models. The first, namely the proposal for new definitions of fractional-order operators, or the fractionalization of some mathematical models, may represent dangerous adventures with possible misleading or even erroneous formulations. The second, that is, the in-depth study of some mathematical formulations, constitutes a solid basis, but its lack of ambition narrows considerably the scope of FC to a limited number of topics.

Possible new directions of progress in FC may emerge in the fringe of classical science, or in the borders between two or more distinct areas. The present paper presents some uncommon, (“strange”) ideas and topics, namely the existence of fractional objects, computational and visualization methods for the analysis of data series, the emergence of power law behavior and the characterization of complex phenomena by means of entropy.

We should have in mind that some of those strange fractional objects “will lead to a paradox, from which one day useful consequences will be drawn”.