New Frameworks in Mathematics: Calculus Without Calculus, fCWC, and WJ-fC: CWC-Series Converge When Taylor Series Cannot, Infinite Families of Identities, Multi-Field Applications from Biotech to AI, Novel Fundamental Operators, and Open Conjectures

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Purpose: A set of two new operators contribute to the development of a new theorem on jumpability that, together with a six-fold characterization of dimensional-expansions, are used to establish Calculus without Calculus (CWC) as a new framework. CWC is contrasted against other branches of math such as q-calculus, h-calculus, (p,q)-calculus etc. CWC is then extended to create two more frameworks: fractional CWC (fCWC) and WJ-fractional Calculus (WJ-fC). Procedure: The expansions are characterized by six properties that outline CWC's operators: the W-operator and the J-operator. CWC is then extended to fCWC, which is further extended to WJ-fC. This model is both self-validated and cross-validated using hyperspheres and calculus. Results: CWC produces CWC-series that are more accurate than Taylor series and converge where Taylor series cannot. New infinite families of identities are derived. When the W-operator is applied to calculus, (i) the Volume-to-Surface area relationships produced by Marichal and Dorf (2007) are extended (ii) an open-problem/conjecture is proposed, and (iii) when constructivist pedagogies are applied, these operators provide easy access to calculus for millions of high school students and non-STEM college students. Conclusions: A novel fractal quantification algorithm powered by CWC-framework is provided to measure fractal objects, including lung surfaces, capillaries and tumors. In medicine, this quantification has many applications in targeted drug delivery. In economics, this algorithm provides an approach to analyze financial markets. Lastly, three conjectures and open challenge problems are provided.

Awards Won:
American Mathematical Society: Honorable Mention and One-Year Membership to AMS (for 5 projects with up to 3 team members per project)