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Exploring Several Algebraic and Operational Properties of Twice-Iterated-λ Appell Polynomials

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Abstract

In this paper, we introduce a new hybrid family of special polynomials, termed the twice-iterated-λ-Appell polynomials, and examine their principal structural properties. Using the monomiality principle and operational methods, we establish the quasi-monomial framework of the sequence and derive the associated multiplicative and derivative operators together with the corresponding differential equations. Explicit recurrence relations, series representations, and determinant forms are also obtained. The proposed construction naturally generates several related subfamilies within a unified setting. In particular, important special cases such as the Bernoulli–λ-Appell and Euler–λ-Appell polynomials are recovered and their properties are discussed. These results extend the theory of Appell-type and λ-polynomials and contribute to the study of hybrid polynomial structures with potential applications in differential equations and mathematical physics.

Keywords: Appell sequences, Appell λ-polynomials, monomiality principle, operational rules, determinant approach.

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