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Introducing Δ_h Hermite-based Appell polynomials via the monomiality principle: properties, forms, and generating relations

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Abstract

The article introduces a novel class of polynomials, ${}_{\mathcal{H}}\mathcal{Q}_m^{[\Delta_h]}(q_1, q_2, q_3, q_4, q_5; h)$, termed Δ_h Hermite-based Appell polynomials, utilizing the monomiality principle. These polynomials exhibit close connections with Δ_h Hermite-based Bernoulli, Euler, and Genocchi polynomials, elucidating their specific properties and explicit forms. Moreover, the research establishes generating relations for these polynomials, facilitating profound insights applicable across diverse domains such as mathematics, physics, and engineering sciences.

Keywords: Δ_h hybrid special polynomials, explicit forms, Appell polynomials, monomiality principle, explicit forms.

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1. Introduction

The Appell polynomial sequences, which constitute a prominent class of polynomial sequences, are employed in various fields such as applied mathematics, theoretical physics, and approximation theory, among others. These polynomials are encountered in numerous problems within these disciplines. Moreover, Appell polynomials satisfy all the axioms of an Abelian group when subjected to the composition operation.

In the eighteenth century, Appell introduced a series of polynomials denoted as $\mathcal{Q}_m(u)$, as described in [2]. These polynomials exhibit a specific relationship:

$$\frac{d}{du}\mathcal{Q}_m(u) = m\,\mathcal{Q}_{m-1}(u), \qquad m \in \mathbb{N}_0,$$

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