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Extensions of Discrete Classical Orthogonal Polynomials Beyond the Orthogonality

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Abstract. It is well-known that the family of Hahn polynomials $\{h_n^{\alpha,\beta}(x; N)\}_{n \geq 0}$ is orthogonal with respect to a certain weight function up to degree N . By using the three-term recurrence relation which this family satisfies, we prove that the Hahn polynomials can be characterized by a Δ -Sobolev orthogonality for every n and present a factorization for Hahn polynomials for a degree higher than N .

We also present analogous results for dual Hahn, Krawtchouk, and Racah polynomials and give the limit relations among them for all $n \in \mathbb{N}_0$. Furthermore, in order to get these results for the Krawtchouk polynomials we will obtain a more general property of orthogonality for Meixner polynomials.