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A System of Four Simultaneous Recursions: Generalization of the Ledin-Shannon-Ollerton Identity,

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Abstract

This paper further generalizes the Ledin-Shannon-Ollerton result, the recent result of Shannon and Ollerton who resurrected an old identity due to Ledin, to all metallic sequences. The results presented in this paper give closed-form formulas for the sum of products of powers of the first n integers with the first n members of the metallic sequence. Three key innovations of this paper are i) reducing the proof of the generalization to the solution of a system of 4 simultaneous recursions; ii) use of the shift operation to prove equality of polynomials; and iii) new OEIS sequences arising from the coefficients of the four polynomial families satisfying the 4 simultaneous recursions.