Nim addition and split extensions basis for 2^n-ons

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Hypercomplex numbers are numbers which are obtained by extending complex numbers using various doubling formulae. They include quaternions, octonions, sedenions and the general 2^n-ons. Consider the non-negative numbers $Z^+ = \{0, 1, 2, 3, \cdots\}$. Nim addition gives a way of defining addition in Z^+ to make it a field of characteristic 2. In this paper we perform the multiplication of basis elements of complex, quaternion, octonion and sedenion split extensions using the Jonathan Smith formula. In each case we show that the multiplication is related to Nim addition. We also show that the multiplication of split extensions for general 2^n-ons can be viewed in terms of Nim addition.

Keywords: Hypercomplex numbers, quaternions, octonions, sedenions, spit extensions, Nim addition.