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ABSTRACT. Using a functional model of a Boolean-valued universe, the so-called polyverse, invented by A.E. Gutman and G.A. Losenkov, we introduce the basic notions of infinitesimal analysis within a Boolean-valued universe, thus enriching the synthesis of the two main branches of nonstandard analysis, infinitesimal and Boolean-valued.

We apply the results obtained to the theory of Riesz spaces. In particular, the following fact is proven: The inverse of the standard-part function for real numbers in a Boolean-valued universe is an isomorphism between an arbitrary uniformly-complete Riesz space (K -space) and the set Riesz space of reals in the corresponding Boolean-valued universe. This function is also an isomorphism between a Dedekind-complete Riesz space with the strong unit and the set of limited numbers in a Boolean-valued universe. Moreover, using the results obtained we construct a new functional representation for K -spaces, ideals, and order-dense ideals of K -spaces and propose analogs of the basic notions of the theory of Riesz spaces in this new representations.