Title: Parameter-independent structure in periodic orbits of an iterated function system on the real line

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For the iterated function system on \( \mathbb{R} \) comprising the maps \( f(x) = ax + 1 \) and \( g(x) = bx \), with \( a > 0 \) and \( 0 < b < 1 \), we represent each \( n \)-cycle by the composition (or word) in \( f \) and \( g \) corresponding to the cycle’s point of least magnitude (or perigee). These representations are partitioned into equivalence classes using simple combinatorial criteria. Associated with each \( n \)-cycle are \( n \) polynomials in \( a \) and \( b \) whose values at a special value of \( a \) are partially ordered. An example is given showing that, for fixed \( b \), the perigee word of an \( n \)-cycle is a function of \( a \); but the ordering of the polynomial values enables us to prove that the maximal perigee word in each equivalence class is independent of the parameters \( a \) and \( b \).

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