Non-standard numeration systems: the algorithmic point of view

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We study algorithms for addition, multiplication and division on the set of numbers having finite representation in a positional numeration system defined by a base β in $\mathbb{C}$ and a finite digit set $\mathcal{A}$ of contiguous integers containing 0. For a fixed base β, we discuss the question of the alphabet allowing to perform addition in constant time independently of the length of representation of the summands. Such addition is a necessarry ingredient in on-line algorithms for multiplication and division. We focus on the properties of algebraic bases β which influence the efectivity of these on-line algorithms. Using the base $\beta = \frac{3+\sqrt{5}}{2}$ and the alphabet $\{-1, 0, 1\}$ we demonstrate that a system with an irrational base can be more suitable for computation than a system with an integer base.