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Simultaneous beta-expansions

We say that x has a beta-expansion with respect to β if there exists a sequence of a_i such that $x = \sum a_i \beta^{-i}$. It is known that if $\beta > 1$ is sufficiently close to 1, and the digits a_i are restricted to ± 1 then all x sufficiently close to 0 have an uncountable number of beta-expansions.

What is surprising is that for any x_1 and x_1 sufficiently close to 0 and $\beta_1 \neq \beta_2$ sufficiently close to 1 we can find a beta-expansion that is simultaneously a beta-expansion for x_1 in terms of β_1 and is a beta-expansion for x_2 in terms of β_2.

We will discuss the proof of this result, the generalization of this to higher numbers of simultaneous beta-expansions, and the limits of these techniques.