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*How uniform is provable convergence?*

Suppose we prove that some family of sequences always converges. Easy examples show that we cannot generally hope to show that the family shares a uniform rate of convergence. However a variety of results show that, if the family is axiomatized in a suitable theory, the family does have a weaker property, a uniform rate of "metastable convergence", and further that a computable bound on this rate can be obtained from the proof in a systematic way.

We investigate how to obtain an intermediate property: uniform bounds on the number of times the sequence jumps. We show how to relate bounds on jumps to the behavior of an extension of the sequence to the nonstandard integers, and how to extract computable bounds on the number of jumps from proofs which give strong convergence behavior even in the nonstandard integers. As an application, we obtain uniform bounds on the number of jumps in the so-called nonconventional ergodic averages.