TIGHT BOUNDS ON PERIODIC CELL CONFIGURATIONS IN LIFE

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ABSTRACT. Periodic configurations, or oscillators, occur in many cellular automata. In an oscillator, repeated applications of the automaton rules eventually restore the configuration to its initial state. This paper considers oscillators in Conway's Life; analogous techniques should apply to other rules. Three explicit methods are presented to construct oscillators in Life while guaranteeing certain complexity bounds, leading to the existence of

- an infinite sequence K_n of oscillators of periods $n = 58, 59, 60, \ldots$ and uniformly bounded population, and
- an infinite sequence D_n of oscillators of periods $n = 58, 59, 60, \ldots$ and diameter bounded by $b\sqrt{\log n}$, where b is a uniform constant.

The proofs make use of the first explicit example of a stable glider reflector in Life, solving a longstanding open question about this cellular automaton.