Smooth Collatz Sequence

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Abstract

In this paper we prove Collatz conjecture by giving an equivalent formulation of the shortcut Collatz sequence.

Collatz theorem

For every integer $x_0 \geq 1$

$$x_{n+1} = \begin{cases} \frac{x_n}{2}, & x_n \; even, \\ \frac{3x_n + 1}{2}, & x_n \; odd, \end{cases} \qquad n \geq 0.$$

$$=$$

$$x_{n+1} = \left\lceil x_n \left(1 - \frac{1}{2}\cos(\pi x_n)\right) \right\rceil$$

$$=$$

$$\left\lceil x_{n+1} = \left\lfloor x_n \left(1 - \frac{1}{2}\cos(\pi x_n)\right) \right\rfloor + 1 - e^{-2\ln\left(\frac{(\pi^2/4)(1+x_0)^3}{\ln(3/2)}\right)\left(x_n\left(1-\frac{1}{2}\cos(\pi x_n)\right) - \left\lfloor x_n\left(1-\frac{1}{2}\cos(\pi x_n)\right)\right\rfloor\right)} \right\rceil$$

Notice that $\lceil sequence \rceil$ means do the ceiling just 1 time in the end.

From the third formulation we have my gift to the math community:

$$\lim_{n \to \infty} x_n = \{1,2\}$$

Everyone is welcome to check $x_0 = 27$ to see how this formulation is so powerful.

Reference

[1] https://antsmath.org/ANTSXIII/PosterSlides/Ghaffor.pdf