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On the Intermittency of a Piecewise Linear Map (Takahashi Model)

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1. Introduction.

We will consider a piecewise linear mapping F from the unit interval $[0, 1]$ into itself for which there exists a sequence $\{c_n\}$ such that $1=c_0>c_1>\cdots\to 0$ and

$$F(x)=\begin{cases} \dfrac{x-c_1}{\psi_0} & \text{if} \quad x\in(c_1, c_0]\,, \\ \dfrac{x-c_{n+1}}{\psi_n}+c_n & \text{if} \quad x\in(c_{n+1}, c_n]\,, \end{cases}$$

where

$$\begin{aligned} \psi_n= & \quad F'(x)^{-1} \quad \text{if} \quad x\in(c_{n+1}, c_n) \\ = & \begin{cases} \dfrac{c_0-c_1}{c_0} & \text{if} \quad n=0\,, \\ \dfrac{c_n-c_{n+1}}{c_{n-1}-c_n} & \text{if} \quad n\geq 1\,. \end{cases} \end{aligned}$$

Y. Takahashi ([7] and [8]) studied the ergodic properties of this mapping by calculating its autocorrelations $\int xF(x)dx$. In this paper, we will consider this problem in more general situation.

This mapping has a fixed point at 0, and there are various cases depending on its property at 0:

1. When $F'(0)>1$, the dynamical system is mixing and the decay rate of correlation is of exponential order. In particular, the central limit theorem holds.
2. When $F(x)-x\sim x^{\alpha}$ such that $\alpha<5/3$, the dynamical system is still mixing, but the decay rate of correlation is of polynomial order. Nevertheless, the central limit

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