

# On the effect of multiplicative noise in a supercritical pitchfork bifurcation

Stefan Reimann

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The most important characteristic of multiplicative noise is that its effects of system's dynamics depends on the recent system's state. Consideration of multiplicative noise on self-referential systems including biological and economical systems therefore is of importance. In this note we study an elementary example. While in a deterministic super critical pitchfork bifurcation with positive bifurcation parameter  $\lambda$  the positive branch  $\sqrt{\lambda}$  is stable, multiplicative white noise  $\lambda_t = \lambda + \sigma \zeta_t$  on the unique parameter reduces stability in that the system's state tends to 0 almost surely, even for  $\lambda > 0$ , while for 'small' noise  $\sigma < \sqrt{2\lambda}$  the point  $\sqrt{\lambda - \sigma^2/2}$  is a meta-stable state. In this case, correspondingly, the system will 'die out', i.e.  $X_t \rightarrow 0$  within finite time.

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