Event-triggered feedback in a noise-driven phase oscillator

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oscillator model, we study the effect of event-triggered feedback on the statistics of
interevent intervals (IEI). Whenever the oscillator enters a new cycle, i.e., an event
occurs, feedback is applied to the system by increasing (positive) or decreasing (neg-
ative) the oscillators frequency. Such models can be used to study spike-triggered
currents in neurons, or feedback mechanisms in laser physics. Beside the known
excitable and oscillatory regime positive feedback can lead to bistable dynamics and
a change of the excitability class. Furthermore, in the excitable regime the feedback
has a strong influence on noise-induced phenomena like coherence resonance or anti-
coherence resonance, i.e., the minimization or maximization of IEI variability for
a certain amount of noise. Interestingly, positive feedback increases IEI variability
for a weak noise, but reduces the variability in the strong noise regime, whereas
negative feedback acts in the opposite way. Therefore, both types of feedback can
enhance the coherence resonance effect by further reducing the IEI variability, but
only positive feedback can lead to anti-coherence resonance, which does not occur
in the absence of feedback.