Entropy Production of the Willamowski-Rössler Oscillator

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Some properties of the Willamowski-Rössler model are studied by numerical simulations. From the original equations a minimal version of the model is derived which also exhibits the characteristic properties of the original model. This minimal model shows that it contains the Volterra-Lotka oscillator as a core component. It thus belongs to a class of generalized Volterra-Lotka systems. It has two steady states, a saddle point, responsible for chaos, and a fixed point, dictating its dynamic behaviour. The chaotic attractor is located close to the surface of the basin of attraction of the saddle node. The mean values of the variables are equal to the (unstable) steady state values during oscillations even under chaos, and the variables are always non-negative as in other generalized Volterra-Lotka systems. Surprisingly this was also the case with the original reversible Willamowski-Rössler model allowing to compare the entropy production during oscillations with the entropy production of the steady states. During oscillations the entropy production was always lower even under chaos. Since under these circumstances less energy is dissipated to produce the same output, the oscillating system is more efficient than the non-oscillatory one.

Key words: Willamowski-Rössler Model; Entropy-production; Generalized Volterra-Lotka Systems; Mean and Steady State Values; Basins of Attraction.