Selective monostability in multi-stable systems

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Proc. R. Soc. A 471: 20150005.

http://dx.doi.org/10.1098/rspa.2015.0005

Abstract.

We propose a robust method that allows a periodic or a chaotic multi-stable system to be transformed to a monostable system at an orbit with dominant frequency of any of the coexisting attractors. Our approach implies the selection of a particular attractor by periodic external modulation with frequency close to the dominant frequency in the power spectrum of a desired orbit and simultaneous annihilation of all other coexisting states by positive feedback, both applied to one of the system parameters. The method does not require any preliminary knowledge of the system dynamics and the phase space structure. The efficiency of the method is demonstrated in both a non-autonomous multi-stable laser with coexisting periodic orbits and an autonomous Rössler-like oscillator with coexisting chaotic attractors. The experiments with an erbium-doped fibre laser provide evidence for the robustness of the proposed method in making the system monostable at an orbit with dominant frequency of any preselected attractor.