

Perturbations of autonomous systems and Lyapunov exponents in non-autonomous systems

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We will consider relations between small perturbations of non-chaotic autonomous dynamical systems and the chaotic behavior of the non-autonomous systems in which they are transformed.

This is made using an extended notion of Lyapunov exponents in non-autonomous systems and that of chaoticity as equivalent to have sensible dependence on initial conditions. As a first example we use the easy difference equation of first order $x_{n+1} = ax_n$ when we perturb the real parameter a and other examples obtained perturbing the same parameter in the logistic equations of first and second order $x_{n+1} = ax_n(1 - x_n)$ and $x_{n+1} = ax_n(1 - x_{n-1})$.

Additionally we will study some relations between the stability and instability of solutions of difference equations with the value of Lyapunov exponents (when they exist), particularly with periodic perturbations or doubling periodic using Jacobi functions. As a consequence, we will construct some pathological examples.