Measuring dynamical complexity

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Abstract

I will discuss, for differentiable dynamical systems, three ways to capture dynamical complexity: (A) hyperbolicity, which measures the sensitivity of dependence on initial conditions, (B) entropy, which measures the predictability of future dynamical events in the sense of information theory, and (C) the speed of correlation decay or equivalently the rate at which memory is lost. I will review these ideas in nontechnical terms, present theorems showing how they are related, and give a very brief (and somewhat personal) survey of the progress made in the last decades. For illustration, I will show how these results apply to a concrete example: shear-induced chaos in periodically kicked oscillators, a phenomenon closely related to that observed by van der Pol nearly 100 years ago.