Stabilization of hyperbolic chaos by the Pyragas metod

Sergey Belyakin, Arsen Dzhanoev, Alexander Loskutov
M. V. Lomonosov Moscow State University, Moscow, Russia; bst@newmail.ru
University of Potsdam, Potsdam, Germany;

For a long time it was a common opinion that hyperbolic attractors are artificial mathematical constructions
[1]. However, in the recent papers [2, 3] there were proposed physically realizable systems that possess, in their phase space, the set with features that are very similar to hyperbolic type of attractors.
As is known, invariant sets are called hyperbolic attractors of the dynamical system if they are closed,
topologically transitive subsets, and every their trajectory possesses uniform hyperbolicity. Very familiar
types of the hyperbolic attractors are Smale-Williams' solenoid and Plykin's attractor.
Further, it is well known that chaotic systems are very sensitive to the external perturbations. This
property is used for controlling nonlinear systems and chaos suppression. Thus, an important question
arises: Is it possible to suppress chaos in systems with hyperbolic attractors because these attractors
are structurally stable subsets?
In the present contribution we study the possibility of stabilization of chaotic oscillations in systems with
the Smale-Williams hyperbolic attractors by means of the Pyragas method with a delay [4]. It is shown
that by means of external perturbation the dynamical system could be controllable: the hyperbolic attractor
degenerates into a periodic one.

[1] A. Loskutov. Physics–Uspekhi **53** 1255 (2010).
[2] S.P. Kuznetsov. Phys. Rev. Lett. **95** 144101 (2005).
[3] S.P. Kuznetsov and A. Pikovsky. Physica D **232** 87 (2007).
[4] K. Pyragas. Phys. Lett. A **170** 421 (1992).