2ⁿᵈ International Conference on

Fluid Dynamics & Aerodynamics

October 19-20, 2017 | Rome, Italy

Anticipating of chaotic dynamics via schemes without time-delay terms

T Pyragiene and **K Pyragas**
Center for Physical Sciences and Technology, Lithuania

One of the ways to forecast the chaotic dynamics is applying of anticipating synchronization (AS). This phenomenon appears in the configuration "drive -response" or "master - slave" where a response system anticipates the dynamics of a drive system. The most popular AS schemes contain a time-delay term in the response system which makes the system dimension infinitesimal. Therefore, analytical and experimental treatments of those schemes become complicated. To simplify the analyzing and implementation of AS schemes, algorithms without time-delay terms were proposed. In this case, the forecasting of the drive's dynamics is not exact, but it is good enough for practical applications. In our works, we realize the regime of anticipating synchronization via introducing two schemes without time-delay terms. The first scheme consists of three chaotic systems: a master system, an intermediate slave system and a terminate slave system. The whole system periodically performs such procedures. The period is divided into three parts. In the first part of the period, the master and the intermediate systems completely synchronize. In the second part, all three systems evolve separately and the intermediate slave system accelerates. In the final third part, the intermediate and terminate slave systems synchronize. The optimal system parameters values were found analytically. Numerical simulations for the typical chaotic systems, namely for the Rössler as well for the neuron Hindmarsh-Rose system, demonstrate a stable AS regime. In our second scheme, we change a time-delay term in the classical Voss scheme by lower order all pass filter (LOAPF). The filter is constructed making use of the methods of the Padé approximation and the Laplace transform. The effectiveness of the scheme is demonstrated for an analytical spiral model and for the chaotic Rössler system. Numerical simulations show that for the filter of the second order (and higher), results coincide with the results obtained with the classical scheme with a time-delay term. The both presented schemes demonstrate that the excluding of a time-delay term simplifies both analytical and numerical investigations of the phenomenon of anticipating synchronization.

Biography

Tatjana Pyragiene takes part in the investigation of the phenomenon of anticipating chaotic synchronization from 2008 till now. In our paper, Phys. Rev. E (2008) 78: 046217, a new coupling scheme is proposed which solves one of the main problems of dynamics prediction - to enlarge the prediction time. In this scheme, a response system possesses a time-delay term which causes a lot of difficulties in the analysis and implementation of the method. Then, applying approximated mathematical methods, simple effective coupling schemes are constructed . They provide an approximated dynamics prediction which is good enough for many applications. For example, for neuron systems, only spikes prediction is important as is shown in our paper, Nonlinear Dyn (2013) 74:297. Recently proposed coupling schemes are described in this report.

tatjana.pyragiene@ftmc.lt

Notes:

J Appl Mech Eng, an open access journal
ISSN: 2168-9873

Fluid & Aerodynamics 2017
October 19-20, 2017

Volume 6, Issue 5 (Suppl)

Page 49