ADAPTIVE CONTROL AND SYNCHRONIZATION OF A 6D HYPERCHAOTIC SYSTEM WITH APPLICATION TO SECURE COMMUNICATION

Michael Kopp[1], Andrii Kopp[2]

[1]***Institute for Single Crystals, NAS Ukraine, Kharkiv, Ukraine***

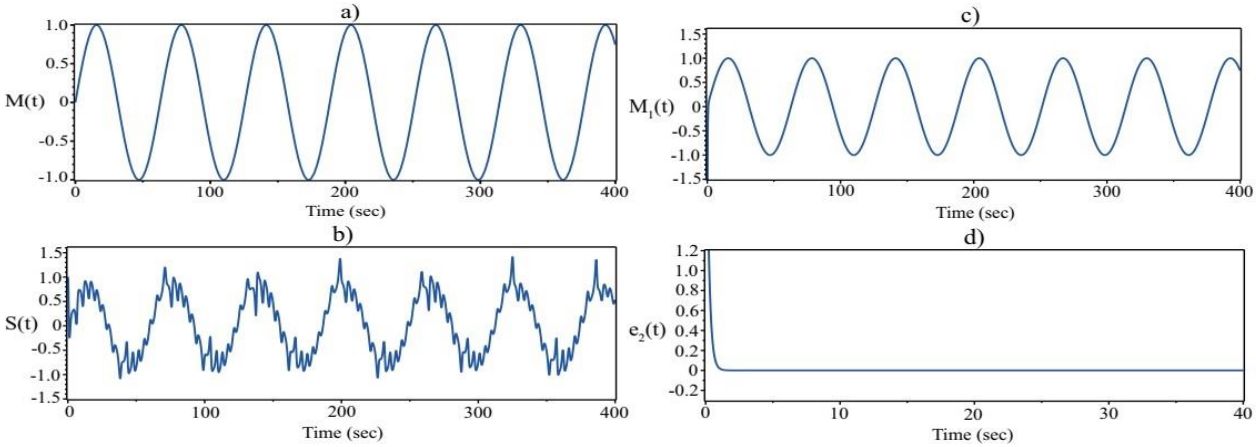
[2]***National Technical University «Kharkiv Polytechnic Institute», Kharkiv, Ukraine***

Adaptive control and synchronization are important methods used to study and control chaotic systems with unknown or uncertain parameters. Adaptive control is used to stabilize the system and suppress chaos. This method has been successfully used to stabilize chaotic systems with unknown or indeterminate parameters.

Many methods have been put forward, such as active control, adaptive control, backstepping control, sliding mode control, and so on [1]. The chaos synchronization problem deals with the synchronization of a couple of systems called the master, or drive system, and the slave, or response system. To solve this problem, control laws are designed so that the output of the slave system tracks the output of the master system asymptotically with time.

In this paper, an adaptive controller is used to stabilize the 6D hyperchaotic system [2] with unknown system parameters, and an active control method is derived to achieve global chaotic synchronization of two identical 6D hyperchaotic systems with unknown system parameters.

Additionally, using an active timing control method, we described the practical application of a 6D chaotic system in secure communications using a chaotic masking methodology. Fig. 1 depict the simulation results for secure communication in the Maple software.



Picture 1 – a) information signal M(t), b) transmitted chaotic signal S(t), c) recovered signal $M_1(t)$, d) error in the information signal $M(t)-M_1(t)$

References:

1. Volos C., Vaidyanathan S. *Advances and Applications in Nonlinear Control Systems.* Springer International Publishing. 2018. 683 p.

2. Kopp M. I., Tur A. V., Yanovsky V. V. Chaotic dynamics of magnetic fields generated by thermomagnetic instability in a nonuniformly rotating electrically conductive fluid. *J. Phys. Stud.* 2023. Vol. 27. P. 2403.