STEVENS Institute of Technology

Arthur E. Imperatore School of Sciences and Arts

Department of Mathematical Sciences

Seminar in Nonlinear Systems

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Encryption Using Binary Synchronization of Chaotic Systems and its Analysis as Stochastic Memory Resonance

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Abstract: Chaotic dynamical systems, which have noise-like broadband power spectra have been found useful for encrypting and masking signals for communication. This has been possible since some chaotic systems have a counter-intuitive property of synchronization. Several techniques have been proposed so far with their relative advantages and disadvantages. A new scheme for chaotic synchronization will be presented which is believed, to have some characteristics that are crucial to efficient encryption. The genesis of the work is a physical concept of practical interest, namely, vortex-induced vibration of engineering structures.

A new synchronization concept – binary synchronization – will be used, which is the outcome of using a drive that is not only nonlinear but multiplicative as well. The drive is generated by a nonlinear mix of chaotic variables having both positive and negative Lyapunov exponents. It is held that this is the first time a nonlinear and multiplicative drive is being used for synchronization. Preliminary study has shown that binary synchronization produces an efficient encryption technique since the ”nonlinear chaotic carrier” has certain desired characteristics.

The presentation will discuss the suitability of the nonlinear drive from a stochastic point of view since the degree of randomness of the drive is the most important parameter for the encryption process. To that end the deterministic nonlinear equations will be converted to an integro-differential equation and then approximated by a stochastic differential equation (sde). The resulting sde is not only nonlinear but multiplicative as well driven by a colored (non-white) noise. Characteristics of this sde will discussed from the point of chaotic encryption.

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