DIFFERENT TYPE OF SYNCHRONIZATION PHENOMENA IN UNIDIRECTIONAL COUPLED UNIFIED CHAOTIC SYSTEMS

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ABSTRACT. *Different types of synchronization phenomena of the unified chaotic systems under the modified PC (Pecora and Carroll) coupling schemes (totally unidirectional coupling in which keeping the master and slave systems with the same dimensions) are investigated in detail. With careful comparison of classical P-C completely synchronization and the effectively synchronization phenomena, projective synchronization are further investigated in this paper. It is found that, the projective synchronization phenomenon exists for all parameter value ranges: $\alpha \in [0,1]$ when coupling two unified chaotic systems through transferring the third variable. This is quite different from the classical situations proposed by Pecora and Carroll. This can be considered as one special case of generalized synchronization phenomenon. Control of the 'projective synchronization scale-factor' is also considered based on theoretical and numerical analysis. In the last part, the effect on projective synchronization (P_jSyn) caused by slight system parameter mismatch and channel noise are also briefly numerically discussed. This character can be further applied in some fields, such as secure communication, etc. Numerical experiments are also provided to show the accuracy of the theoretical analysis.*
Keywords: Complete synchronization, Effectively complete synchronization, Projective synchronization, Unified chaotic system, Channel noise, Parameter mismatch

1. **Introduction.** Since the pioneering work of chaos synchronization proposed by Pecora and Carroll, there have been intensive studies about chaos synchronization in almost all fields of science [1]. In the present studies, scientists usually say two systems are synchronized if the difference(s) between state variable of systems become a constant with time evolution. If the constant equals zero, it is named as complete synchronization [2], otherwise, it is named as effectively complete synchronization [3].

Recently, a specific chaotic system, referred to as a unified system by other authors, has recently been discovered. It contains the Lorenz and Chen chaotic systems as two dual