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# On fractional-order hyperchaotic complex systems and their generalized function projective combination synchronization

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## Abstract:

Some fractional-order hyperchaotic complex systems are introduced in this paper. These hyperchaotic systems appear in several fields of applied sciences, e.g., secure communication and laser physics. The values of the fractional-order and the parameters at which these systems have hyperchaotic attractors are calculated based on the sign of their Lyapunov exponents. The fractional Lyapunov dimension is computed for these hyperchaotic attractors. On the other hand, we introduced the new definition of what is called generalized function projective combination synchronization (GFPCS). This new kind of synchronization may be considered as a generalization of many kinds of synchronization in the literature. To study this kind of synchronization we state a scheme based on the tracking control technique. An example is considered for the scaling functions which is the nonlinear one. The active control method cannot be used in this scheme since its error is large.

## Keywords:

Fractional-order hyperchaotic system Lyapunov exponent Fractional Lyapunov Generalized function projective combination synchronization Tracking control

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