

The Generalized Chaotic System in the Hyper-Complex Form and Its Transformations

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Abstract: The paper deals with the development of the mathematical backgrounds to design the novel chaotic systems by transforming existent ones. These backgrounds are based on using well-known shift, rotation, and scale transformations and we offer using hyper-complex numbers to simplify these transformations and represent the transformed chaotic system by using the 1st order ordinary differential equation. In such form all well known, newly discovered and unknown chaotic systems have the similar mathematical models that are differs only by used nonlinear function of hyper complex variable in the right hand expression. That is why the consideration chaotic system dynamic in the hyper-complex domain allows us to simplify initial system definition as well without applying any transformations. This fact simplifies mathematical definition of chaotic systems and their modeling and simulation. The right-hand expression of the transformed equation in this case are defined as the combination of transformation hyper-complex numbers and source system nonlinearity which is given in the hyper-complex domain. We offer to use variable transformation factors to improve the performance of the considered chaotic system. Since the above-mentioned variable factors can be produced by other chaotic systems, we suggest designing the novel chaotic system by combining existed ones with the linear transformations. As an example, we consider the transformation of the well-known Lorenz system and show the differences between the source system and target one.

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