Amplitude death in globally coupled chaotic systems with delay

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The phenomenon of amplitude death refers to a situation where individual oscillators cease oscillating and become synchronized in a fixed point state when they are coupled. In this work we investigate the emergence of amplitude death in systems of chaotic oscillators, such as Rössler and Lorenz, subject to a global interaction with a time delay. The appearance of synchronization in general, as well as the phenomenon of amplitude death are studied on the space of parameters of the system, given by the strength of the coupling and the amount of time delay. The regions of parameters where amplitude death emerges on this space exhibit a complex structure, such as islands of chaotic synchronization and islands of death. We have uncovered two distinct scenarios for the occurrence of amplitude death: (i) synchronization and amplitude death occur simultaneously, and (ii) synchronization precedes amplitude death. We identify the conditions for the occurrence of both scenarios and propose a simple geometric interpretation for them.

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