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SYNCHRONIZATION ANALYSIS FOR CHAOTIC COMMUNICATION ON A SATELLITE FORMATION FLYING

Abstract

Chaotic based communication systems have drawn increasing attention in the last years. The intrinsic complexity embedded on the chaotic dynamics with its hallmark property of sensitive dependence on initial conditions provides a masterful framework that can be exploited to developed remarkable fast, efficient and robust communication systems at low cost. The main idea is to embed the information signal in the chaotic signal that is transmitted over the communication channel. The remarkable properties of those systems have being extensively demonstrated on laboratory experiments. Very recently, a field experiment using commercial optical network was undertaken in which messages encoded in a chaotic waveform were successfully transmitted at gigabit per second range over 120 km of optical fiber in the metropolitan area network of Athens, Greece. Chaotic based communication systems, due to its remarkable characteristics of efficiency and robustness, can also be used to support communication intensive distributed process over a network. This is also the scenario that may exist when the concept of satellite formation flying is used, in special in the case of cluster formations. A satellite cluster is a group of satellites that fly within close range of each other. The cluster operates as a "virtual" satellite with a very large capability that would require a huge, complex and expensive monolithic satellite. In this work, we analyze the synchronization issue, which is the framework to build a communication strategy based on chaos for a satellite formation flight scenario. For this case, the propagation time of the signal among the satellites must be taken in consideration. This time is not the same for the satellite. As so, we analyze strategies for synchronization that must be used according with the topology of the configuration. Our finds show that even in very demanding scenario, it is possible to achieve synchronization among the satellites so that chaotic based communication can be implemented properly. Furthermore, the conditions required to achieve synchronization are determined as so as the performance picture of the overall system.