Seminar

Institute for Plasma Research

Title : Collective dynamics of globally delay-coupled complex Ginzburg-Landau oscillators

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Time : 10.30 AM

Venue : Committee Room 3, (New Building), IPR

Abstract:

A model system consisting of a coupled set of complex Ginzburg-Landau oscillators and its variants have been widely used as a paradigm for the mathematical study of a large variety of nonlinear phenomena in physical, chemical and biological systems. One of the reasons behind the popularity and extensive applicability of this model is the great variety of collective behavior exhibited by this system ranging from synchrony to chaos and many intermediate states between them. The present study is devoted to an investigation of the effect of time-delayed coupling on the collective dynamics of this popular paradigmatic model. Since time delay arising from finite propagation speed of signals or latency time of chemical reactions or biological processes is inevitable in most real-life systems, our motivation is to determine the existence and stability domains of the various collective states in the presence of such delays. Detailed numerical investigations show that time delay has indeed a significant impact on the characteristic properties of the collective modes that include synchronous states, clustered states, chaos, amplitude mediated chimeras and incoherent splay states. In general, time delay is found to lower the threshold value of the coupling strength for the occurrence of such states and to shift the existence domain towards more negative values of the linear dispersion parameter. The stability properties of these modes are determined using a combination of numerical and analytical methods. In the limit of a small time delay (compared to the intrinsic frequency of the oscillators) the model system is found to acquire nonlinear contributions in the coupling mechanism that enables a comparison with past model studies where such couplings have been adopted in an ad-hoc fashion.