THE CRM APPLIED MATHEMATICAL AND PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA

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Predicting phase and amplitude variation in transient neuronal states

Abstract:

The phase of an oscillator such as a spiking neuron is one of the main indicators of the effects of external stimuli on the (membrane potential) dynamics, and a key information to study synchrony in biological oscillators. Experimentally, the phase advancement is mostly computed through phase response curves (PRCs) obtained from recordings of the time variations in reaching the next peak of the membrane potential; successful methods have been used to predict it by means of theoretical PRCs evaluated on the attractor (limit cycle).

However, stimulation in transient states may induce phase advancements that differ from the predictions given in the asymptotic state. By computing the isochrons (curves of constant phase) in a vicinity of the limit cycle, we are able to accurately generalize the PRCs to the transient states and, as well, to provide a methodology to compute the phase advancement under any type of stimulus (weak or strong, instantaneous or long-lasting). We use this methodology to illustrate how classical (non-transient) PRCs do not reflect important differences among cells such as bistability. We will also present theoretical examples to illustrate the goodness of the generalized PRCs, especially in cases of "weak" attractors or high-frequency stimuli.

Finally, we will remark how the knowledge of second-order PRCs, together with a geometrical interpretation of the isochrons, can help to use the contribution of successive return times to refine experimentally computed PRCs.

Date:	**February 20, 2014**
Place:	**Room C1/028**
Time:	**12:00**